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DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL

Picking Beans at Woombye.

LEADING FEATURES

Tobacco Growing.
Fertilizing Potatoes in the Lockyer Valley.
The Scale Control Programme.
Control of the Cotton Web-Spinner.
Plants Poisonous to Sheep.
Hot Weather and Milk Quality.
Bacteria in Milk.
Pneumonia and Paratyphoid of Pigs.
Housing of Poultry.

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Event and Comment.

Tobacco-growing in Queensland.

ON his return from the recent meeting of the Australian Agricultural Council at Canberra, the Minister for Agriculture and Stock, Hon. H. H. Collins, stated that an increase in the price of tobacco over rates ruling in 1946, based on grades in the table of limits, amounting to 87½ per cent., over 1939 prices had been approved. It was agreed further to seek an investigation into the desirability of including smoking qualities and aroma in the tobacco leaf price schedule.

Discussing the marketing of tobacco, Mr. Collins said that the Council had recommended consideration of the following resolutions:—

(*a*) That a general marketing authority with majority producer representation be constituted to control the marketing of domestic leaf.

(*b*) The appointment of State committees is not considered essential to the scheme, although their appointment would ensure close liaison with the States on marketing problems.

(*c*) Contracts between growers and manufacturers to be permitted subject to the contracts being approved by the central authority, and proper provision being made for the valuation of leaf grown under contract.

(*d*) That the valuation of leaf should be by an appraisal committee comprising representatives of sellers, buyers, and the central authority.

(*e*) Valuation should be determined by a table of limits based on grades and quality.

(*f*) Allocation of leaf amongst manufacturers should be undertaken by a suitable committee approved by the central authority.

With regard to (*b*), in discussion it was recognized that there would have to be either State boards or some such authority in order to give any Commonwealth board some statutory control.

It would therefore seem that, on the whole, the conference had been favourable to the advancement of the tobacco industry.

Reviewing the position of tobacco growing in Queensland generally, Mr. Collins referred briefly to the history of the industry and the events which led up to the appointment of the Australian Tobacco Investigation Committee about 20 years ago. Tobacco had been grown in Queensland, he said, for over 60 years, but through various causes production declined until in 1926 the aggregate cropped area was less than 100 acres. The tobacco acreage in other States had also diminished seriously. The possibility of reviving the industry was inquired into by the Commonwealth Government and Dr. Darnell Smith was sent to the United States to investigate the conditions of the industry over there. A comprehensive and valuable report on the tobacco soils of the United States was an outcome of this investigation. A study of Australian soil types comparable with those of the American tobacco growing regions followed. The Tobacco Investigation Committee instituted a large number of experiments in Mareeba district of North Queensland, as well as in other States of the Commonwealth. Mareeba was regarded, however, as having the best prospects. Although the number of tests was much greater in Queensland than in the other States, the results were, with some exceptions, all good, Queensland leaf being outstanding especially in respect of combustion and aroma. It was recognized then, as now, that the best leaf was that grown in North Queensland where, in consequence, tobacco growing expanded comparatively rapidly. The industry also received a similar impetus in other States. This general development was arrested, however, by subsequent tariff changes.

As with other crops, tobacco acreage, yield, quality, and price are the essential factors determining the farm income. A good case can be made out for an increase in the price to the Australian tobacco grower to enable the industry to pay a reasonable return on his investment, without unduly increasing retail costs to the consumer.

With an assured and enduring home market and with satisfactory pecuniary adjustments, there is no reason why tobacco growing in Queensland should not develop into a major factor in our rural economy.

Fertilizing Potatoes in the Lockyer Valley.

W. J. CARTMILL, Soils Chemist, Agriculture Branch.

POTATOES have been grown in the Lockyer and Fassifern Valleys for many years, and, in the past, satisfactory crops were produced without recourse to the use of artificial fertilizers. This is evidence that the fertility of the soils was initially high, for the potato is a gross feeder and makes heavy demands on the plant food resources of the soil.

Recently, however, the practice of using artificial fertilizers for potatoes has been adopted by farmers in certain parts of the Lockyer, and most of them claim to have increased yields thereby. Some farmers are using fertilizers on areas where they are probably unnecessary, while others do not fertilize on soils known to be deficient in plant nutrients. Because of a lack of knowledge of the plant food requirements of the soils, the choice of fertilizers is usually haphazard, and mixtures of various kinds are in general use. Information obtained from soils investigations and field experimental plots is given here to assist farmers in choosing the right fertilizer for their soils and so obtain the most profitable returns for the money expended.

Plant Food Requirements.

An adequate supply in the soil of all the essential plant nutrients is necessary for the satisfactory growth of potatoes. The three major plant foods—nitrogen, phosphoric acid, and potash—are required in liberal amounts and a deficiency of any one of them results in low yields being obtained even when the other two are present in sufficient amounts. The three major plant foods are the chief ingredients of artificial fertilizer mixtures, though some mixtures contain only two of them. A mixture containing all three is known as a complete mixture. A complete mixture should be used only when the soil contains insufficient of all three of the major plant-foods to meet the requirements of the particular crop being grown. Some crops are more exacting than others in their requirements of a particular plant food, so that a soil could be deficient in a certain nutrient for one crop yet contain sufficient of that nutrient for the requirements of some other crop.

A knowledge of whether or not a soil is deficient in any particular plant food for a particular crop can only be satisfactorily obtained from a properly conducted experiment on the soil type concerned. Furthermore, such an experiment is necessary to determine the optimum amount of fertilizer to apply to the soil to give the most

profitable crop response. The composition of the soil, determined by chemical analysis, then serves as a useful criterion for assessing the probable requirements of soils of the same type in the same district when the crop is grown under similar conditions.

Signs of Deficiencies.

An extreme deficiency of any one of the plant nutrients is often manifested by characteristic leaf symptoms in the growing plant. For instance, if the nitrogen supply is insufficient the potato plant is stunted in growth, the leaves become a pale yellowish-green colour, and the period of growth is shortened. The tubers from nitrogen-deficient plants are small and the total yield is light. A severe deficiency of phosphoric acid causes the leaves—particularly the terminal or bud leaves—to become a pale-green or bluish-green colour. The plants develop slowly and ripening is delayed. The resultant yield is poor both in number and in size of tubers. Potash-deficient plants assume a stunted bushy habit of growth. The leaves in the early growth period are abnormally dark-green in colour, and later become bronzed in appearance and marked by brown dead-tissue spots. The edges of the leaves curl downward. The lower or oldest leaves may die prematurely and the plant take on a stripped appearance.

Balance in Fertilizer Mixtures.

To obtain the best results from the application of artificial fertilizers, it is necessary to have the mixture properly balanced. In other words, the amount of nitrogen, phosphoric acid, or potash added to the soil should be such as to make the proportion of each present in the soil suitable for the particular crop. This amount will vary according to the soil and the conditions under which the crop is grown. If a soil is inherently high in phosphate content only nitrogen and potash may be required, and the application of a complete mixture to such a soil would not only be poor economy but the addition of the unnecessary phosphate may upset the balance of the nutrients so that the maximum increased yields for the nitrogen and potash added may not be obtained.

Purpose of Using Fertilizers and Manures.

Though potatoes can be grown satisfactorily on almost any well-drained soil of reasonable fertility, the crop thrives best on fertile loamy soils containing adequate quantities of organic matter. The function of the organic matter is to supply soil humus, which, as well as providing plant foods, has a beneficial effect on the structure or tilth of soils, particularly of heavy soils, keeping them loose, open, friable, and permeable to water. Organic matter greatly improves the water-holding capacity of light soils.

The purpose of using artificial fertilizers is simply to correct any deficiency of the major plant-foods in the soil. They do not correct other deficiencies such as lack of organic matter, insufficient cultivation or moisture deficiency, nor do they make a naturally poor soil fertile.

A soil which is inherently fertile may become depleted of one or more of its plant-foods by the removal of crops from the soil over a period of years to such a degree that there remains insufficient of the

nutrient or nutrients to satisfy the requirements of all crops. Other factors also cause a depletion of plant nutrients in a soil under cultivation, and of these the decomposition of humus, which causes a loss of nitrogen and the leaching out of plant foods from the top soil by water, is important. The loss of humus can be retarded by turning under crop residues and green manures. The best green manures are leguminous crops, such as cowpeas, which add nitrogen to the soil as well as organic matter. The loss of mineral plant foods (for example, phosphate and potash) must be made up by using fertilizers; and it is often necessary to supplement the nitrogen supply by using inorganic nitrogenous fertilizers even though a green manure has been turned under.

The best artificial fertilizer to use for the purpose of supplying nitrogen for the potato crop is sulphate of ammonia. Nitrate of soda is sometimes used, but for the conditions under which potatoes are grown in the Lockyer and Fassifern Valleys its use is not recommended. Potash is usually applied as muriate of potash or sulphate of potash, and phosphates, when required, as superphosphate. Phosphate fertilizers are not required in the Lockyer soils.

The Soils of the Lockyer Valley.

Soils investigations conducted in the Lockyer Valley during the last three or four years have revealed that considerable variation exists in the chemical and physical composition of the alluvial soils of the valley. While the inherent fertility of the soils is generally good, laboratory investigations have indicated that certain deficiencies may occur in some areas, more particularly in relation to nitrogen and potash. The phosphate status of the soils is high in all parts of the valley, and the phosphate is present in a form that is readily available to plants.

The soils have been formed from unconsolidated alluvial deposits of considerable thickness laid down on the valley floor. In texture they range from sandy loams to clays, but clay loams and clays are dominant. The lighter soils occur mainly at the western end of the valley beyond Gatton and up Tent Hill, Flagstone, and Ma Ma Creeks. Below Gatton the soils are heavier and clay loams and clays are the chief soil types over the main part of the valley. Lighter soil types occur in places along the creek banks, which is in accord with normal flood plain deposition. The soils of the Laidley Creek Valley are also of the heavier type, though they get lighter towards the head of the creek.

The lighter soils are characterized by a generally low nitrogen content and a high available phosphate and potash content. The heavier soils have mostly a fair nitrogen content, and are high in available phosphate, but their potash contents vary considerably, being quite low in some areas though generally satisfactory. The soils have one property in common—they all contain an abundant supply of available phosphate.

Potatoes are grown on all the soil types, but the most favoured for the crop are the lighter permeable soils such as occur at the head of the creeks and the "creek-bank" soil.

Fertilizer Trials.

So far only a small number of field experiments have been conducted. The results obtained from these confirm the general deductions in regard to nutrient deficiencies arrived at from the analytical data obtained for the various soils. Thus soils low in nitrogen content respond to applications of nitrogenous fertilizers, and soils low in potash to potash fertilizers. No response to phosphate has been obtained.

The first field experiment was laid out in the spring of 1944 on a grey-brown clay loam typical of a broad area of alluvial soil on the south side of Lockyer Creek between Grantham and Gatton. In this experiment a response to nitrogen applied as sulphate of ammonia was obtained, but none to phosphate and potash. The experiment was repeated on another farm on the same soil type in the autumn of 1946, and similar responses were obtained.

Yield data obtained in the latter experiment for applications of sulphate of ammonia are shown in the following table:—

Amount of Sulphate of Ammonia (cwt. per acre).	1st Grade Tubers (tons per acre).	1st and 2nd Grade Tubers (tons per acre).
Nil	4·4	5·4
2	4·8	5·8
4	5·5	6·5

The increased yield of first grade tubers due to an application of 4 cwt. per acre of sulphate of ammonia amounts to over 1 ton per acre, which is a very profitable response.

In the same season a similar experiment was set out on Laidley Creek, near Mulgowie. In this case a response was obtained to potash. Nitrogen and phosphate applications proved to be of no value.

Yield data for this experiment for muriate of potash applications were as follows:—

Amount of Muriate of Potash (cwt. per acre).	1st Grade Tubers (tons per acre).	1st and 2nd Grade Tubers (tons per acre).
Nil	4·4	4·9
1	5·0	5·5
2	5·5	6·0

The increase in yield due to an application of 2 cwt. per acre of muriate of potash was over 1 ton of first grade tubers per acre.

Recommendations.

Until further field trials have been conducted, it is not possible to make specific recommendations for all the soil types of the Lockyer, but with the knowledge obtained from the experiments so far

conducted, together with the analytical data for soils representative of all parts of the district, certain broad general recommendations can be made.

Lockyer Creek Area.

The grey-brown soil covering the area south of Lockyer Creek between Grantham and Gatton appears to be deficient in nitrogen for the potato crop, and benefits from applications of sulphate of ammonia may be expected. Amounts of up to 4 cwt. per acre profitably increase the yield of first grade tubers on that soil.

Tent Hill, Ma Ma and Flagstone Creeks Areas.

Soils of a similar type and similar in chemical composition occur on Tent Hill, Ma Ma and Flagstone Creeks, and it is probable that these soils would also benefit by applications of sulphate of ammonia.

Laidley-Mulgowie Area.

The soils in the Laidley-Mulgowie area of the Laidley Creek valley are characteristically low in potash and in a field trial potatoes responded well to applications of muriate of potash. Rates of up to 2 cwt. per acre returned profitable increases in yield of 1st grade tubers. Phosphate fertilizers are of no value, as the soils in that area contain adequate quantities of this plant food. Nitrogen applications also proved to be unnecessary in the field trial. Chemical analyses indicate that, although most soils in this area contain fair quantities of nitrogen, the amount of this plant food varies in the soils of the area. The system of farming, intensity of cropping, of cultivation, or irrigation and other local factors could cause a variability from farm to farm. It is possible, therefore, that on some farms applications of nitrogenous fertilizers may be beneficial. Further experiments are required to determine this. Until further information is available farmers in this area are strongly advised to plough under a leguminous green manure crop prior to planting potatoes in order to improve the nitrogen status of the soils and offset any possible deficiency of the nutrient.

General.

At present the fertilizer trials are not sufficiently far advanced for a statement of the precise fertilizer requirements (if any) of all the soils of the Lockyer. It would appear, however, from the chemical data available for the various soils that there is a possibility of a nitrogen deficiency occurring in some areas. To provide for any such contingency (partially at least) and until the results of field trials are known, the ploughing under of a leguminous green manure crop before planting potatoes would be a sound practice for farmers to adopt in all parts of the district.

Potash is present in fairly good amounts in most of the soils of the Lockyer, and unless shown to be beneficial by field experiments the general use of potash fertilizers is not advised. Quite probably some soils other than those already known to be potash-deficient will be found to require potash as a soil amendment, but the areas are not likely to be extensive. At the same time it should be realized that potatoes are heavy users of potash, so that a soil repeatedly cropped to potatoes could, in time, become potash deficient although the soil type in general may be well supplied.

Phosphate is abundantly supplied in all the alluvial soils of the valley, and phosphate fertilizers are unnecessary.

The soils are slightly acid to slightly alkaline in reaction, though mostly neutral. The use of lime or dolomite is therefore unnecessary, and moreover is undesirable because of the probability of increasing the incidence of "scab".

Time and Method of Application of Fertilizers.

Fertilizers are usually applied in the drill at planting time. When this method is used, care should be taken to ensure that the fertilizer is covered by a layer of soil or mixed with the soil in the drill before the setts are placed because of the risk of injury to the setts by contact with the fertilizer, which would produce "misses" in the crop.

Work in other countries, more particularly in America, indicates that best yields are obtained when the fertilizer is placed in bands 2 inches to each side of the setts and at a slightly lower level.

Other work has shown that when sulphate of ammonia is used as a fertilizer the highest yields are obtained when about half the fertilizer is applied at planting time, and the remainder applied as a side dressing at about the flowering stage.

QUEENSLAND SHOW DATES FOR 1947.

March.

Pittsworth	4th and 5th
Millmerran	7th and 8th
Cherbourg	7th and 8th
Goombungee	8th
Toowoomba	17th to 20th
Dalby	25th to 27th
Tara	28th and 29th

April.

Chinchilla	1st and 2nd
Miles	17th and 18th

May.

Mount Perry	2nd
Marburg	3rd
Kingaroy	3rd and 5th
Taroom	5th, 6th, and 7th
Yarraman	5th and 6th
Monto	7th and 8th
Nanango	8th, 9th, and 10th
Beaudesert	9th
Ipswich	13th to 16th
Wondai	15th, 16th, and 17th
Murgon	22nd, 23rd, and 24th
Esk	22nd, 23rd, and 24th
Warrilview	23rd
Biggenden	29th and 30th
Gympie	29th, 30th, and 31st
Kalbar	30th
Blackbutt	30th and 31st

June.

Maryborough	5th, 6th, and 7th
Boonah	6th and 7th
Childers	9th and 10th
Gladstone	12th and 13th
Bundaberg	12th, 13th, and 14th
Lowood	13th, 14th, and 16th
Gin Gin	16th and 17th
Rockhampton	18th to 21st
Toogoolawah	20th and 21st
Mackay	24th, 25th, and 26th
Laidley	27th
Proserpine	27th and 28th

July.

Charters Towers	1st, 2nd, and 3rd
Kilcoy	3rd and 4th
Rosewood	11th and 12th
Nambour	17th, 18th, and 19th
Gatton	18th and 19th
Crow's Nest	30th and 31st
Innisfail	31st, and 1st and 2nd

August.

Lawnton	2nd
R.N.A., Brisbane	9th to 16th

September.

Rocklea	13th
Beenleigh	19th and 20th

PLANT PROTECTION

The Scale Control Programme in Citrus Orchards.

A. W. S. MAY, Assistant Entomologist.

QUITE a number of scale insects are common pests of citrus and the several species exhibit different breeding habits. Nevertheless, the late summer-autumn period has been found a most appropriate time to apply control measures. In addition, weather conditions at this time of the year are reasonably cool and the trees are less liable to injury than they would be during the hotter weather of mid-summer.

Red, circular black, mussel and soft scales have four or more generations each year and breeding is continuous during the warmer months. The maximum rate of reproduction occurs during January, but as the cooler autumn weather approaches the breeding rate slackens prior to the onset of partial dormancy during the winter. Pink wax scale has only two generations each year, the first occurring in November and the second in March. The hatching of white wax scale, on the other hand, may be protracted through the summer months, though this insect has only one generation each year.

Scalicides are particularly efficient against newly hatched scales and accordingly their application should, where possible, be timed to coincide with the occurrence of young insects on the trees. Such conditions are normally encountered between February and April. As the breeding rate is then declining, scale populations can be drastically reduced and the trees enter the winter in good condition and remain clean for a relatively long period.

Scalicides.

In coastal areas most citrus growers rely on sprays for the control of scale insect pests. Various insecticides are used according to the type of scale or scales to be controlled.

A white oil emulsion, at 1 in 40 strength, is used extensively against red, circular black and the soft scales. It is rather less efficient against the mussel scale and is of little value against the wax scales, particularly when more mature individuals are predominant among the population.

A soap and washing soda spray is recommended for use against the pink wax scale, but good results can only be expected when treatment follows after the emergence of the second generation "crawlers,"

which occurs between late February and April. This spray is mixed according to the following formula:—5 lb. high grade laundry soap, 12-14 lb. fresh washing soda, and 75 gallons water.

The resin—caustic soda—fish oil spray is a very efficient scalicide, the value of which lies mainly in its ability to control a mixed infestation of species, including either or both the pink wax and white wax scales. A stock emulsion may be prepared on the orchard to the recommended formula or purchased commercially for dilution when required.

In inland districts, where red scale is the predominant scale insect pest encountered, fumigation is the primary control measure for all scale pests in the late summer-autumn period. The efficiency of this treatment may be lessened by unfavourable weather conditions or the use of worn sheets. An alternative method of controlling red scale in these districts requires the use of a white oil (1-40) spray, applications of which are less subject to the vagaries of the weather than is fumigation.

Combination Sprays.

Invariably, orchardists find it necessary to cope with a mixed population of scale insects in their trees and a combination spray containing soap, washing soda and white oil is very useful on trees infested with red, circular black, mussel and the wax scales. It is prepared according to the following formula:—2 lb. high grade laundry soap, 8 lb. fresh washing soda, 1½ gallons white oil and 75 gallons water. In hot weather, this mixture may burn the foliage and its use should be confined to relatively cool periods in the late summer and autumn months.

In coastal districts where brown spot is a disease of Emperor mandarins, a combination spray containing cuprous oxide mixture (honey formula, 3-40) and white oil may be employed when red scale is present on the trees. The fungicide may also be combined with the soap-washing soda mixture used for pink wax scale control. A further combination, comprising cuprous oxide, together with soap-washing soda-oil, is also useful to combat brown spot and a mixed infestation of red scale, mussel scale and pink wax scale on trees of this variety.

Conditions Necessary for Control Measures.

Scale control measures during the late February-April period should be timed to coincide with the emergence of a new generation of the pest. In the case of pink wax scale, the late summer brood of young scales may be expected to appear between late February and late April. "Crawler" emergence is normally spread over a period of approximately one month and spraying should be delayed until it is completed. By this time the older individuals will have attained the size of an ordinary pin head. The efficiency of a soap-washing soda spray drops quickly from that time onwards. Consequently, if many of the young scales are larger than an ordinary pin-head, it may be wise to substitute the somewhat more efficient resin–caustic soda–fish oil spray for the soap–washing soda mixture normally used.

In the case of red, circular black and mussel scales, individuals of all ages are invariably present on the trees and the timing of control measures is far from easy. However, late summer-autumn has proved the most suitable period for the control of these species. Treatment then ensures that the fruit will be free from infestation when harvested.

The time of application of a scalicide is no more important than the method of using it. In the case of all sprays, the ingredients should be measured accurately and fresh materials should be employed wherever possible. Thorough agitation of the spray in the vat is essential during its application.

Although an efficient spray may be employed, the insect must be wetted by the spray before results can be expected. It is not an easy task to thoroughly wet a large citrus tree with the spray, but every effort should be made to achieve this object and so obtain the maximum benefit from the treatment.

Generally speaking, weather conditions are usually more favourable for the use of scalicides in late summer-autumn than at other periods of the year. Nevertheless, citrus growers should postpone control measures if temperatures are abnormally high, for the foliage and tender twigs are easily scorched. This condition applies particularly to the use of the soap–washing soda–white oil combination spray. Vigorous healthy trees are better able to withstand the effects of spray applications during periods of warm weather than trees showing symptoms of stress.

Spray Applications and Fruit Maturity.

The time of application of scale control measures is particularly important in districts where red, circular black and mussel scales are common pests. Control measures should be applied sufficiently early to ensure clean fruit at harvesting which will realise the full market value of the crop. Early varieties of citrus, such as lemons and grapefruit, are therefore usually treated for red scale control during January. Varieties such as navel and Joppa oranges, which may not be harvested until late March and April, are best sprayed between mid-February and early March, depending on the occurrence of suitable weather for treatment. Scale control measures can be applied to mid-season and late varieties at any time during March and April.

However, it must be borne in mind that an interval of approximately one month must elapse between the use of an oil spray and harvesting, for colouring of the fruit can be delayed if this interval is reduced.

CHANGE OF ADDRESS.

Changes of address should be notified at least fourteen days before the date of issue with which the change is to take effect. The former address should be given as well as the full Christian names and surname of the subscriber.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Control of the Cotton Web-Spinner.

IAN F. B. COMMON, Assistant Entomologist.

DURING the spring of 1946 a number of crops in central and southern Queensland, including cotton, peanuts, lucerne, sorghum and Sudan grass, were damaged by the cotton web-spinner.* The larvae of this pest are readily recognised, for they are associated with large quantities of webbing which they spin over their host plants. The

Plate 22.
ROLY POLY WEED DEFOLIATED BY COTTON WEB-SPINNER.

adults are small, inconspicuous, greyish-brown moths which become very numerous in the field and around artificial lights, to which they are strongly attracted.

Sources of Infestation.

Cotton web-spinner moths lay their eggs on a number of weeds commonly found growing on fallow land, on headlands and amongst crop plants where cultural operations have failed to keep the area clean. Such weed hosts include black pigweed, red pigweed, hogweed,

* *Loxostege affinitalis* Led.

roly poly and Bathurst burr. Lucerne is the only cultivated crop upon which egg-laying has been observed. Frequently very large populations of the larvae develop on weeds and lucerne and these provide a source of infestation for neighbouring crops. When the weeds or lucerne are severely damaged by the larvae, or are no longer suitable for their development, the pest is likely to invade cotton and other crops nearby.

Nature of Damage.

The weed hosts of the cotton web-spinner are generally completely defoliated (Plate 22) during an attack, but in most cases recovery of the plants follows further rain. The foliage of lucerne is skeletonised

Plate 23.
Two Months Old Cotton Plant, showing Cotton Web-spinner Damage.

and webbed together, thus greatly reducing the quantity and the quality of the hay produced. If other crops are attacked while young —and for the most part this is the case when an outbreak occurs in the spring—replanting is frequently necessary. Especially does this apply where weeds are prevalent amongst the crop plants, for once the infested weeds are destroyed by the insects or removed by cultivation, the larvae turn their attention to the only remaining source of food—the young crop plant. If the larvae are numerous, defoliation of the young plants is often fatal even when insecticides are applied.

An attack by the cotton web-spinner on older crop plants may cause considerable leaf damage (Plate 23), before control measures are effective, but usually the tips remain uninjured and, if growing conditions are good, the plants frequently will recover.

Life History and Habits.

The adults of the cotton web-spinner lay their small, scale-like eggs, which overlap one another, in groups of up to nine usually on the fresh young growth of some weeds and lucerne. In from two to four days in summer the young larva hatches from the egg and soon begins to spin over the host plants the characteristic webbing in which it is capable of rapid movement, either forwards or backwards. In summer, after about three weeks' development, the larva descends to the ground and enters the soil, where it constructs a silk-lined tunnel up to one and a half inches in depth. At the bottom of this tunnel transformation to the pupal or resting stage takes place. About one week afterwards the moth emerges.

The winter is spent in the pupal stage and the moths emerge following September rains. The larvae hatching from the eggs laid by these moths complete their development in late October. The second generation of moths is therefore on the wing in early November and the larvae produced by them are prevalent during the remainder of that month. It was this November generation of larvae which recently proved so troublesome in central and southern Queensland.

Further generations of the pest may occur before the end of the summer, but their fate is governed by such factors as climatic conditions and the relative activity of natural enemies. Small parasitic wasps and flies are the most important natural enemies of the cotton web-spinner and, under normal circumstances, they are effective in preventing outbreaks.

Control Measures.

Methods adopted for the control of the cotton web-spinner vary according to the source and extent of the attack. It is important to remember that egg-laying seldom, if ever, occurs on cultivated crops other than lucerne. Thus attacks upon cotton, peanut, sorghum and Sudan grass crops are always in the nature of larval invasions from other host plants, such as lucerne and weeds, upon which the earlier development of the insect has taken place. Such invasions may originate from weeds growing within the crop, from weeds on headlands or from weeds and lucerne in adjacent cultivation paddocks.

Where lucerne is heavily infested with cotton web-spinner larvae, the crop should be cut immediately. Any adjacent crops should then be watched closely in case protective measures are necessary to destroy larvae migrating from the lucerne.

The maintenance of cultivated crops free from weed growth cannot be too strongly emphasised as a counter against this and other pests. It has been noted again and again that crops growing under conditions of clean cultivation and situated some distance away from weedy headlands and fallow ground remain free from attacks by the cotton web-spinner. Should large numbers of larvae be observed attacking weeds within or adjacent to a crop, prompt action must be taken. The weeds should be sprayed or dusted immediately with

D.D.T. or lead arsenate in order to destroy the insects. On no account should cultivation be attempted until the insects on the weeds have been destroyed, for any mechanical disturbance of the weed hosts will lead almost inevitably to an invasion of the crop by the larvae.

If the larvae have begun to migrate from outside the paddock towards the crop, one or more furrows should be drawn across their path and a cutworm bran bait distributed in the furrows and amongst the advancing larvae. This bait contains 25 lb. bran, 2 quarts molasses, 1 lb. Paris green and 2½ gallons water mixed into a wet, crumbly mash.

Frequently an invasion of the crop has already commenced when first the pest is noticed. The invaded area and a marginal strip at least 12 feet in width should be sprayed immediately with an 0.1% D.D.T. emulsion or dusted with a 2% D.D.T. dust. If the plants are small, this measure may not save those already attacked, but it should destroy most of the invading larvae before the remainder of the crop is affected. However, if the larvae are present in very large numbers and the invasion is well advanced before it is noticed, the crop can be defoliated completely before the insecticide has time to destroy the insects, and replanting may be necessary.

In earlier outbreaks, when cotton plants at least one month old have been attacked, effective control was obtained by sprinkling a swabbing mixture on the plants with a whitewash brush. The swabbing mixture contains 1 lb. lead arsenate, 1 gallon molasses and 6 gallons water. This mixture is easy to apply and can be used most economically. Because of the danger of poisonous residues, insecticides containing arsenic cannot be applied to fodder crops which are to be fed to stock.

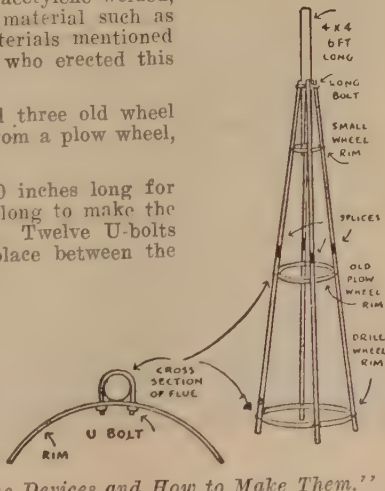
HOME-MADE TOWER FOR WIND-CHARGER.

To make a tower for a battery charger, take some boiler flues from an old steam engine and get them acetylene welded, making four pipes each 16 ft. long. Other material such as piping can, of course, be used, but the materials mentioned here are those used by the farmer concerned who erected this type of tower.

A piece of 4 x 4 about 6 feet long and three old wheel rims were used, one from a drill wheel, one from a plow wheel, and a third about 12 inches in diameter.

Four long bolts were used, two about 10 inches long for the top of the flues and two about 14 inches long to make the 4 x 4 secure in the small rim at the top. Twelve U-bolts were used, four to fasten each rim in its place between the upright flues.

This makes a tower 18 ft. high and one that will last a long time. It can be made secure to the ground by means of iron stakes or cement blocks. Such a tower would therefore be quite easy to make from scrap material and, if no wheel rims were available, something else could be devised to do in their place.



—From "Handy Farm and Home Devices and How to Make Them."

APPLIED BOTANY

Plants Poisonous to Sheep.

S. L. EVERIST, Assistant Botanist.

(*Continued from December, 1946, page 25.*)

Ellangowan Poison Bush.

Other Common Names: Turkey bush, dogwood.

Botanical Name: *Myoporum deserti*, A. Cunn.

Description: Shrub, 3-5 feet high; branches thin; leaves alternate, thick in texture, narrow, 1-2½ inches long, tapering to a fine point; flowers white, bell-shaped, about ¼ inch diameter, borne singly or in clusters of 2 or 3 on curved stalks in the forks of the leaves; fruits round, about ¼ inch diameter, leaves bitter and burning to taste. (See Plates 24 and 25.)

Plate 24.

ELLANGOWAN POISON BUSH.—Mature plants, west of Springsure.

Distribution: The plant is common in Western Queensland and extends to the Burnett, Wide Bay, Port Curtis, and Moreton districts, though it is not common in coastal areas. It grows in a wide range of soils but is most plentiful in forest country, especially ringbarked gidyea, brigalow, and box forests.

Seasonal Occurrence: Deaths are not confined to any one season and the plant is potentially dangerous at all times.

Evidence of Poisoning:

(*a*) Field: On many occasions Ellangowan poison bush has been suspected of causing deaths of both cattle and sheep. The plant has a delayed action and animals often remain unaffected until two or three days after eating it. A drink of water hastens the onset of symptoms.

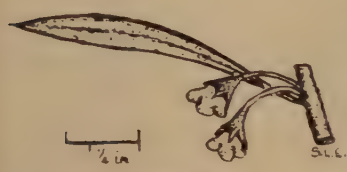


Plate 25.
Ellangowan Poison Bush.—Twig with leaf and flowers.

(*b*) Feeding Tests: The plant was fed to sheep at Cunnamulla and produced symptoms characteristic of those shown by animals affected on stock routes. A total of 1¾ lb. of leaves and fine twigs fed to a sheep produced no symptoms for the first 24 hours, but killed the animal in 48 hours. Minced leaves and fruits produced symptoms after 4 hours when 8 ounces had been consumed, the animal dying in 48 hours after eating 12 ounces of the material.*

(*c*) Chemical: It has been reported than an oil contained in an allied plant (*Myoporum acuminatum*) is a general tissue poison and it is possible that Ellangowan poison bush contains a similar oil.

Symptoms: The symptoms are described *as drowsiness with gradual closing of eyelids, lowering of head, and arching of back; body temperature became sub-normal and respiration deep. Later the sheep collapsed and lay on the brisket, became semi-comatose and could not run when disturbed. Watery swelling of the jaw and yellowed membranes were noted prior to death.

Post Mortem: The main features reported on post mortem were some yellowing of mucous membranes, excess amber fluid in all body cavities, stagnation of the lower bowel with severe drying out of contents and haemorrhages of most surfaces lining the intestines. Blood was usually plentiful inside the intestines.

Prevention: Paddock sheep sometimes eat this plant sparingly, apparently without ill-effect. If eaten by travelling stock it is very dangerous. In moving sheep or cattle through patches of this plant, the best plan is to let them feed for an hour or more before entering the patch, then keep driving them until poison-free pasture is reached. To camp mobs of sheep or cattle where Ellangowan poison bush is growing generally leads to heavy losses.

Treatment: No remedy is known.

Caustic Vine.

Other Common Names: Caustic bush, pencil caustic.

Botanical Name: *Sarcostemma australe* R.Br.

Description: Leafless scrambler or bush with smooth, greyish-green, jointed stems often climbing to the tops of trees and hanging

* Johnstone, I. and Allen, G.: *Aust. Vet. Journ.* Vol. 20, p. 227, 1944.

Plate 26.
CAUSTIC VINE.—Mature plant, near Eudlo.

down from the branches; stems with milky juice; flowers creamy-white, star-shaped, in clusters at the joints; pod 2-3 inches long, pointed at the top, splitting lengthwise when ripe; seeds flat with a tuft of silky hairs at one end. (See Plates 26 and 27.)

Distribution: Caustic vine is found in nearly all parts of the State in a variety of situations. It often grows on rocky hills and tablelands.

Seasonal Occurrence: In good seasons the plant is not eaten to any extent. Most trouble occurs in dry times when other feed is scarce.

Evidence of Poisoning:

(*a*) Field: For very many years the plant has been suspected of killing sheep and cattle.

(*b*) Feeding tests: In feeding tests *sheep have been killed with as little as 2 ounces of the fresh minced plant and the plant has also been fed to cattle and horses with fatal results.

(*c*) Chemical: Caustic vine has been found to contain a saponin.

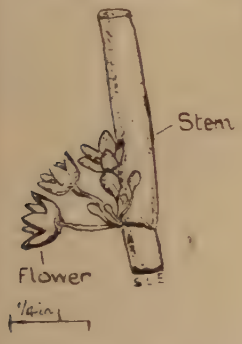


Plate 27.
CAUSTIC VINE.—Portion of stem with flower cluster.

Symptoms: The symptoms have been given as follows:—†"The animal first appears restless and uncomfortable. Later, staggers develop and the animal goes down, breathing becomes rapid, and the animal grunts. It makes violent running movements when down, the head may be thrown out stiffly, neck muscles show great rigidity for a time and then relax. Sometimes the animal will shut the mouth tightly and resist any effort to open it. At other times there is a marked champing of the jaws with grinding of the teeth and free flow of saliva. Vomiting may occur. Gradually the running movements become weaker and the animal dies.

Post Mortem: Post-mortem examination reveals little abnormality. The paunch is distended with gas and there may be a clear, straw-coloured fluid in the chest cavity.†

Prevention: If the plant is not too plentiful it is best to grub it out. If this is not possible, it is well to keep hungry sheep out of reach of caustic vine unless ample other feed is available in the paddock. Care should be taken in handling the plant as the sap is sometimes irritant to the skin, especially to people with fair complexion.

Weir Vine.

Other Common Names: None reported.

Botanical Name: *Ipomaea calobra*, Hill and F. Muell.

Description: Vigorous vine with numerous trailing stems from a thickened rootstock; lateral roots bearing large watery tubers about 1-2 feet below the soil surface; leaves on long stalks, heart-shaped, sometimes more than 4 inches across; flowers funnel-shaped, about 3 inches across, borne in loose clusters on long stalks; "petals" changing colour from pink to blue; seed pods rounded, ¾-1 inch diameter, containing several dark, angular seeds. (Plate 28.)

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* Gilruth, J. A., and Murnane, D.: *Jour. C.S.I.R.*, iv., p. 225, 1931.

† Moule, G. R.: Department of Agriculture and Stock: Advisory Leaflet, Vet. Sec. 30, 1942.

Plate 28.

WEIR VINE (*Ipomœa calobra*).—A. Base of corolla laid open to show stamens. B. Capsule. C. Seeds. The whole reduced to the same scale.

Distribution: Weir vine has a very restricted distribution. So far as is known, it occurs only on red soils with mulga and ironbark in the districts around St. George, Surat, and south of Roma.

Seasonal Occurrence: In infested areas this plant is usually the first to grow after early spring rains. It is killed by frost. Some people regard it as most dangerous after spring rain when it is in vigorous growth and other feed is comparatively scarce, while others consider it is most poisonous when bearing seed pods.

Evidence of Poisoning:

(*a*) Field: For many years the plant has been strongly suspected of causing losses in sheep and field evidence against it is fairly conclusve.

(*b*) Feeding tests: The limited feeding tests which have been carried out have given negative results, but in view of the field evidence this cannot be regarded as conclusive.

(*c*) Chemical: No work on determination of a poisonous principle has been reported.

Symptoms: It is reported *that affected animals become excited when worked and raise their heads and tails, pointing them straight out. They develop staggers. The knee joints become swollen and apparently the animals do not recover from this condition even when put on good pasture.

Post Mortem: Post-mortem examination of sheep showing signs of weir vine poisoning but taken off weir vine country 10 days previously showed all organs normal, except the lungs, which were much enlarged and, apart from dark blotches, pale in colour.*

Prevention: Experiments by the Lands Department indicate that eradication of the plant is not difficult, though it costs from 13s. 6d. to 15s. per acre to clear most country of weir vine. The best method of eradication is to grub the vines, then pour over the exposed central root about an egg-cupful of arsenic pentoxide solution (1 lb. arsenic pentoxide to 1 gallon water). Such treatment kills the whole of the root system, including the tubers.

During the winter, sheep may be run on weir vine country without ill effects. With early spring rains, even as little as 50 points, weir vine comes up and such country then is dangerous until the first frosts have killed the vines.

Soda Bush.

Other Common Names: None recorded.

Botanical Name: *Threlkeldia proceriflora* F. Muell.

Description: Erect, densely branched herb or subshrub up to 2 ft. high; leaves alternate, succulent, very narrow, almost cylindrical, $\frac{1}{4}$-$\frac{3}{4}$ in. long; flowers and fruits in forks of leaves, closely pressed against the stem, cylindrical, hard, dry, about $\frac{1}{4}$ in. long, with five very short, narrow teeth at the top. (See Plates 29 and 30.)

Note.—The cylindrical fruit closely pressed against the stem and without sharp spines serves to distinguish this plant from two very similar plants, red burr† and yellow burr.‡

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* Carew, J. Unpublished report, Department of Agriculture and Stock files, 1934.

† *Bassia echinopsila* F. Muell.

‡ *Bassia anisacanthoides* (F. Muell.) Anders.

Distribution: Soda bush is common in Western Queensland, where it grows in great abundance on heavy clay soils, especially on stock routes, reserves and other heavily grazed areas in the region between Charleville and Longreach.

Seasonal Occurrence: The plant is most plentiful after spring and summer rains. If rain falls in late summer or autumn, soda bush persists well into the winter.

Plate 29.

SODA BUSH.—Mature plant, near Barcaldine.

Evidence of Poisoning:

(*a*) Field: Soda bush first came under suspicion in 1938 after heavy losses in sheep in the Ilfracombe and Longreach districts. Since then many losses have been attributed to the plant.

(*b*) Feeding tests: Tests at Yeerongpilly‡ showed the plant to be poisonous to sheep. One merino wether was killed by 1 lb. of minced plant, two by 2 lb. each and two others by 5 lb. each. One ate 3 lb. without apparent effect.

(*c*) Chemical: A high oxalic acid content has been recorded in specimens from Western Queensland. Animals fed experimentally

‡ Legg, J., and Francis W. D.: *Aust. Vet. Journ.* xv, pp. 168-171, 1939.

became hypocalcaemic (deficient in blood calcium). The lowering of blood calcium follows when oxalic acid in the plant combines with the calcium in the blood to form insoluble calcium oxalate.

Symptoms§: Deaths from soda bush poisoning occur at two fairly clearly defined periods:—

(*a*) A few hours after eating the plant (most deaths occur in this period).

(*b*) Up to several days later.

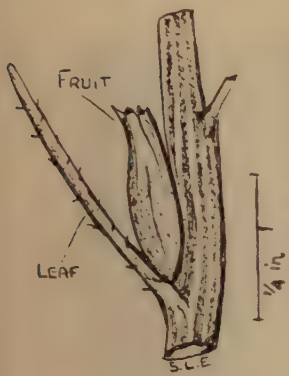


Plate 30.
SODA BUSH.—Part of stem with leaf and fruit.

Hungry sheep affected 4-6 hours after eating soda bush lag behind the mob, then suddenly rush about as if frightened. They develop a rolling gait, the body muscles tremble and face muscles twitch, and they froth at the mouth. Later, the animals go down on their briskets with the head turned over the shoulder as if asleep. Sometimes the head is stretched out with the underside of the neck and lower jaws flat on the ground. Food and liquid are regurgitated through the nose and mouth. Occasionally this fluid is blood-stained. At first, breathing is rapid and forced. Later it becomes slow and almost imperceptible and at this stage the animal is dull and appears to be dazed. Death soon follows. Often, when hungry sheep eat large quantities of this plant just before they go into the brake at night, no symptoms are seen. Next morning affected animals are found dead in the attitude of sleep.

Sometimes, a few straggling deaths take place at any time up to a week after the sheep have eaten soda bush. Such sheep appear depressed and show marked scouring. The dung is dark-coloured.

Post Mortem: On post mortem most affected sheep showed marked congestion of the lungs and fourth stomach. Heart vessels and capillaries under the skin were engorged and some haemorrhages were present under the epicardium. Kidneys were also congested in some sheep and in some the lungs showed pneumonia due to fluid material from the mouth entering the trachea and reaching the lungs.‡ In cases where deaths are delayed, post-mortem examination shows inflammation of the fourth stomach, large intestine and small intestine and blood-stained faeces.§

Prevention: Sheep in the paddock do not like the plant and rarely eat enough to cause trouble. Nearly all deaths have been in hungry travelling sheep which have come suddenly upon the succulent herbage and eaten large quantities. Animals unloaded from railway trucks after long journeys are particularly susceptible. If there is much soda bush on the route to be travelled, such sheep should be given a quantity of hay or other feed before they are put on to the weed.

Treatment: Sheep which go down early should be given an injection of calcium borogluconate solution (see the first part of this series). Travelling mobs should be rested for a few days.

§ Moule, G. R.; personal communication.

Mint Weed.

Other Common Names: Wild mint, narrow-leaved sage.

Botanical Name: *Salvia reflexa* Hornem.

Description: Annual herb, generally 1-2 ft. high, often smaller; stems angular; leaves opposite, bluish-green, narrow, 1-2½ in. long; flowers in opposite pairs or clusters of three or four arranged in spikes at the ends of the branches; calyx ribbed; "petals" blue, about ⅓ in. long, 2-lipped, the lower lip twice as long as the upper; fruit of four small nuts at the bottom of the calyx-tube. (See Plate 31.)

Plate 31.
MINT WEED.

Distribution: The plant is native to North America. In Queensland it is a naturalized weed on the Darling Downs and in the Springsure, Clermont and Tara districts. It has been found at the head of Aramac Creek and in the St. George district and recently has made its appearance in the Moreton district. It thrives on the richest soils.

Seasonal Occurrence: The plant grows profusely after spring rains. It persists right through the summer, though very hot, dry weather will cause it to die off quickly. It is killed by frost.

Evidence of Poisoning:

(*a*) Field: In Queensland, several cases are recorded where deaths of sheep and cattle were attributed to this plant.

(*b*) Feeding tests: Feeding tests both in New South Wales and Queensland have given positive results. These showed that 2 lb. of dried leaves and small stalks were sufficient to kill sheep and young cattle within three days.

(*c*) Chemical: The poisonous principle is potassium nitrate.* In the animal, this is converted to nitrate, causing methaemo-globinaemia (a condition in which the blood cannot take up oxygen).

Symptoms: Animals affected show no symptoms for a while, then they stand apart, breathing rapidly. There is twitching of the muscles and the animal soon goes down. If touched, the animals twitch violently but are unable to rise. Death follows after a few hours. The tongue and mucous membranes become bluish.

Post Mortem: On post mortem, the lungs are sometimes discoloured, sometimes normal except for slight engorgement. The liver and kidneys are congested and the blood chocolate coloured.

Prevention: Sheep eat this plant only if very hungry and the best way of avoiding trouble is to keep them as full as possible. On some narrow stock routes which carry little else but mint weed it may be advisable to give the sheep a small supplementary feed.

Treatment: Sheep usually recover if given one or two injections of methylene blue solution (see the first part of this series).

Wild Sunflower.

Other Common Names: Crownbeard, American dogweed.

Botanical Name: *Verbesina encelioides* Benth. & Hook.

Description: Rough, much-branched annual, usually 3-5 ft. high, densely clothed with white hairs; leaves opposite in lower part of stem, often alternate in upper part, roughly delta-shaped, edges toothed, leaf-stalk broadened at the base into a pair of leaf-like expansions; flowers in heads like small sunflowers, 1-2 in. across, bright yellow in outer part, dark yellow in centre. (See Plates 32 and 33.)

Distribution: The plant is a native of America. In Queensland it is plentiful in the Lockyer, Darling Downs and Maranoa districts and has been found as far north as Blackall. It generally favours sandy or silty soils, especially on stock routes and in roadside ditches and silt banks. It also grows profusely in some ringbarked brigalow and belah country on the western Darling Downs.

Seasonal Occurrence: The plants grow rapidly after spring and summer rains and die out in winter.

Evidence of Poisoning:

(*a*) Field: There is a difference of opinion among graziers as to whether wild sunflower is poisonous or not, but several cases are on

* Williams, C. H., and Hines, H. J. G.: *Aust. Vet. Journ.*, Vol. 16, pp. 14-20, 1940.

record where it is reasonably certain that it was the cause of death. Though most deaths have been with poor travelling sheep, trouble has also been experienced with paddock sheep in good condition.

Plate 32.
WILD SUNFLOWER.

(*b*) Feeding tests: In New South Wales, feeding tests showed that 8 oz. of fresh stems and leaves would kill sheep in from 16 to 36 hours. The same amount of dry plant caused death in 24 hours. At Yeerongpilly, feeding tests were conducted with young leaves only, a sheep consuming 37½ lb. over a period of 39 days without ill effect.

(*c*) Chemical: The stems have been found to contain nitrate but the leaves are apparently free from it. The symptoms are not those of

Plate 33.
Inflorescence and Leaf of Wild Sunflower.

nitrate poisoning. It has also been suggested that the plant may contain a cardiac glycoside. Though the actual poisonous principle is not yet known, it is possible that it is present in the stems but not in the leaves. This would explain the discrepancy between the results of feeding tests in New South Wales and Queensland and might also account for the difference of opinion among graziers.

Symptoms: In the field, animals are usually found dead. In the New South Wales feeding tests, animals became dull and listless, with respiration slightly accelerated and shallow.

Post Mortem: The main appearance is reported to be that of pneumonia, with acute congestion of the lungs and pleuritic effusions.

Prevention: Although some graziers state that the plant may be grazed safely by paddock sheep, others maintain it is dangerous to all sheep. It is advisable to avoid turning hungry sheep on to large patches of the plant, especially if they are travelling.

Sunflower Daisy.

Other Common Names: Yellow daisy, wild daisy.

Botanical Name: *Wedelia asperrima* Benth.

Description: Annual herb up 2 ft. high, very rough to the touch; leaves opposite, usually toothed on the edges, about 2 in. long; flower heads on long stalks, like small yellow sunflowers about 1 in. across; seed-heads containing dark brown seeds. (See Plate 34.)

Distribution: The plant is fairly common on heavy soils about Hughenden, Richmond and Julia Creek. It also extends to the Gulf country and the Northern Territory.

Seasonal Occurrence: Sunflower daisy comes up thickly after summer rains and persists through to early winter.

Evidence of Poisoning:

(*a*) Field: Several cases of pneumonia in rams untrucked at sidings along the Great Northern railway were ascribed to eating this plant.

(*b*) Feeding tests: At Townsville, seeds, leaves and fine stems of mature plants were fed to sheep and goats. One sheep died 18 hours after receiving 3½ oz. of the plant. A goat given 4 oz. one day and 5 oz. the next died on the morning of the third day. Three sheep died in less than 24 hours after receiving watery extracts from ¾ to ½ lb. of the chaffed plant.*

(*c*) Chemical: No work on the nature of the poisonous principle has been reported.

* Mulhearn, C. R.: *Queensland Agricultural Journal*, Vol. 52, pp. 397-400, 1939.

Symptoms: In typical cases* affected animals stood with drooped head and ears. Quivering and spasms of the muscles followed, giving the animal a stiff-legged appearance. Later, the animal went down and showed marked muscular spasms as evidenced by uncontrolled leg

Plate 34.
SUNFLOWER DAISY.—*Dried specimen.*

movements and champing of the jaws. Respiratory distress was also noted. Death occurred about half an hour after going down. A quantity of blood-stained fluid issued from the nose a short time after death.

* Mulhearn, C. R.: *Queensland Agricultural Journal*, Vol. 52, pp. 397-400, 1939.

Post Mortem: Severe inflammation of the fourth stomach and the first portion of the small intestine is reported on post mortem.* A quantity of straw-coloured fluid containing jelly-like clots is present in the abdominal cavity and the chest cavity. There is congestion of the lungs, varying in degree in different animals.

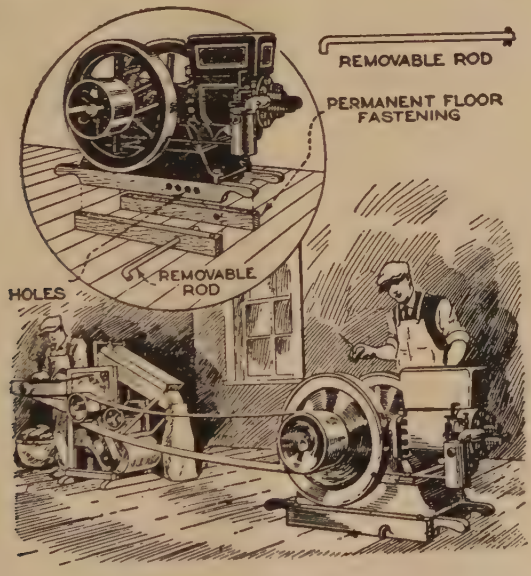
Prevention: Paddock sheep either ignore the plant or eat insufficient to cause death. All mortalities recorded have been among travelling sheep, mostly rams unloaded from railway trucks on to reserves or stock routes or even into paddocks containing this plant. Sheep should not be unloaded from railway trucks on to patches of sunflower daisy.

* Mulhearn, C. R.: *Queensland Agricultural Journal*, Vol. 52, pp. 397-400, 1939.

[TO BE CONTINUED.]

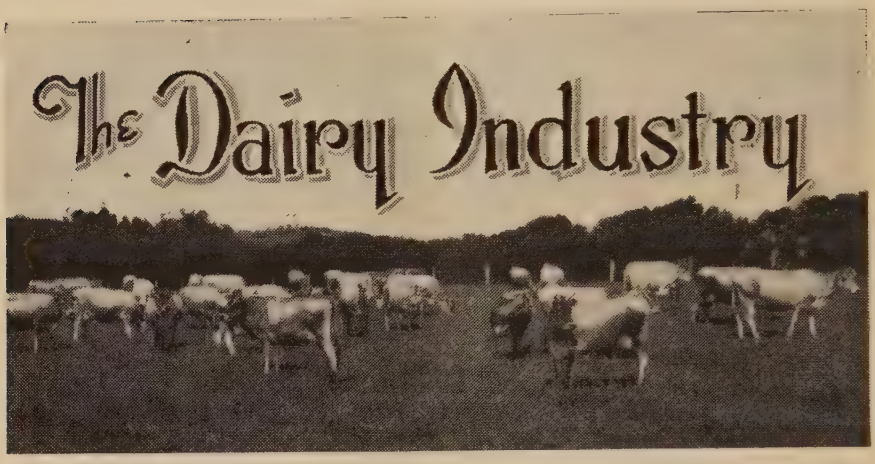
THE FARM ENGINE—ADJUSTABLE BASE.

The problem of holding down an engine without resorting to the usual method of bolting it to the floor is solved by this portable and adjustable base. Two heavy wooden beams are bolted to the underside of the engine, their ends projecting



far enough to be used as handles. Two similar beams, somewhat shorter, are permanently attached to the floor so that those on the engine will fit between them. A removable rod is then pushed through the holes drilled in all four beams, to lock them together and hold the engine down securely. One hole is drilled through each outside beam and a series of holes through the inner ones so that the two base members can be locked together at different points, to obtain proper belt tension. Floor beams of the same type are attached near every engine-driven machine so that, to attach the engine, it is only necessary to slide it into place and slip in the rod.

—*From "Handy Farm and Home Devices and How to Make Them."*



Hot Weather and Milk Quality.

V. R. SMYTHE, Assistant Dairy Technologist.

DURING periods of changeable weather (from cool to hot and *vice versa*) it is interesting to observe the quality of the milk coming in for the city trade, and how it fluctuates with each change of temperature. As soon as the weather becomes warmer in its advance to summer temperatures the quality of fresh milk goes off and more trouble is expected by the people concerned with the maintenance of milk quality. As an example, showing just how much lowering in quality occurs in summer as compared with winter, take the years 1942-43-44 when the mean percentage of milks with methylene blue tests below the standard of 4 hours was 6·5 for the month of June, i.e., during cool weather. But for the month of January, midsummer, this percentage rose to 60·5—almost 10 times as great. Such an increase cannot be attributable to any cause other than increased temperatures. The important thing is that the farmer does not necessarily change his methods of production, but the conditions of production are altered for him during hot weather, and if he is not aware of what is going on there can be plenty of trouble in store for him too.

It is important to remember that increased air temperature affects milk quality in a number of ways. Firstly, higher temperatures favour the development of micro-organisms in the dairy. They grow abundantly on all surfaces where there is any moisture—on buckets, cans, vats, in pipes lines, in teat cups, or on milkers' hands—and unless killed these bacteria will contaminate milk from these sources and continue to grow in the milk, causing quality to decline. Then, secondly, warm weather means that the cooling of milk is done entirely with water which, at best, is only slightly below atmospheric temperature. Consequently, on summer days it is impossible to cool milk to a temperature sufficiently low to prevent the onset of bacterial spoilage.

High air temperatures affect milk quality in another way, and this occurs during transport and storage. Any deterioration happening during transport or storage is increased as air temperature increases, and as the period of transit increases with heavier summer loads.

Water Cooling Systems.

The cooling of milk with water is done, in the case of the "washboard" type of cooler, by circulating water through the interior of coils while the warm milk flows over the outside. With the "beehive" type of cooler, the water remains stationary. Such cooling, in summer, does very little more than remove the body heat from the milk, but this, nevertheless, is necessary and therefore very important. There is one unbreakable rule in milk cooling and this is that the cooling must be done immediately after the milk is drawn from the cow. Shock cooling is what is really necessary.

Several devices are used to lower the temperature of the water for cooling. Water pumped from an underground concrete tank by power from the dairy engine during milking is usually quite cool. With other methods the evaporation principle is applied, as with the ordinary canvas water-bag, to cool water. Originally a large canvas bag left hanging in a shady, breezy spot between milkings was used, but water capacity of this type is obviously very limited. A vast improvement on the bag idea is the cooling tower. Many of these have been installed recently, notably in the Beaudesert district. The water trickles over the tower and is cooled by evaporation. Technically, the cooling efficiency depends on the difference between the wet- and dry-bulb temperature readings. The temperature, of course, cannot be lowered below that of the wet bulb. In near-coastal areas, where the relative humidity is generally low, the wet-bulb temperature reading is usually considerably below ordinary air temperatures, and in those localities the tower cooler works well.

However, while all these devices for cooling water, which is used in turn to cool milk, are useful and helpful they are not quite adequate to ensure that spoilage does not occur.

Milk Deterioration.

Just how necessary cooling is may be seen from tabulated results (see table below) which show how very rapidly milk deteriorates when it is not cooled. These results were obtained by experiment on fresh farm milks.

EFFECT OF STORAGE TEMPERATURE ON METHYLENE BLUE TEST OF FRESH FARM MILKS TWO HOURS OLD.

Storage Temperature. °F.	Deterioration Gradient (decrease in the reduction time for every ½ hour increase in storage time up to 5 hours). Minutes.
41	−2.2
50	0
59	2.0
68	8.2
77	13.3
86	19.9
95	23.4

A large number of milks were sampled and stored at various temperatures from 40 deg. to 95 deg. for five hours. That is, all temperatures from cold to hot were represented. The test used to determine the quality of the milk was the methylene blue test. It was found that when the temperature was 60 deg., or below, practically *no* spoilage of the milk occurred. When the temperature was over 60 deg., however, spoilage did occur, and the amount of spoilage increased as the

temperature increased. Here is one example: When the temperature was 86 deg., as it often is on a Queensland summer day, the methylene blue test fell off by almost *20 minutes* for each *half hour* it was held at that temperature. *These were fresh milks, no more than two hours old when tested.*

So that the old idea, that a freshly drawn milk, cleanly produced, will stand transport or short storage without deteriorating is quite wrong. In fact, good quality farm milks show a slightly faster rate of deterioration than poor quality milks. This may sound anomalous, but it is true nevertheless, although the difference is slight.

Several points must be obvious from this. Milk must be cooled to as low a temperature as possible immediately after milking and, further, it must be handled as quickly as possible, so that it arrives at the depôt before it has time to lose quality.

Bacteria in Milk.

P. McCALLUM, Dairy Officer.

A GREATLY increased demand for milk in recent years has placed a greater emphasis on quality, both by the distributors and the consuming public. Moreover, as public health standards, particularly in relation to bottled pasteurized milk, require milk to comply with rigid standards, milk processors are ever on the alert to see that their product meets the requirements of the Health and Dairy Produce Acts.

In recent years there has been a big change over by many dairymen from cream to milk production, and farmers have had to become conversant with many milk-quality tests such as the sediment test and the methylene blue test. However, milk may comply with these tests but still be unsatisfactory for the pasteurized milk trade. For this trade milk must have what is known as good "pasteurizability"; that is, the bacterial flora must be capable of being reduced to low numbers. Milk of good quality usually possesses good "pasteurizability." Poor quality milk often contains high numbers of heat resistant organisms, which survive pasteurization, and thus has poor "pasteurizability."

High bacterial counts in milk after efficient pasteurization are due to thermoduric and thermophilic bacteria. Added interest in these bacteria has occurred in recent years, and it is hoped that the following remarks will assist milk producers in understanding their relation to milk quality.

Thermoduric bacteria are heat-resisting micro-organisms—that is, they are not readily destroyed by heat—and about 90 per cent. survive ordinary pasteurization temperatures, but do not grow at such high temperatures. *Thermophilic* bacteria are heat-loving micro-organisms which actually grow or multiply at pasteurization temperatures. Thermoduric and thermophilic bacteria, while not dangerous in themselves or harmful to mankind, are nevertheless an index of some flaw in production methods, and their presence cannot be ignored. In high numbers in a producer's milk they point conclusively to some flaw in production technique—most often improperly cleansed and sterilized equipment.

The following are some of the common sources of contamination of milk by heat-resistant and heat-loving bacteria:—

1. Milking machines which are improperly cleansed and sterilized, especially if there is milkstone or corrosion on any part of the plant caused by improper cleansing methods.—It is surprising how many users of milking machines fail to carry out the correct cleansing technique. Most manufacturers supply with each machine sold a cleansing methods chart, which is usually tacked up on the wall of the milking shed, but many producers are unaware of the instructions thereon. After use, the machine should be first flushed with cold water, then with hot caustic soda (or other cleanser) solution, and finally with clean *boiling* water. Where a steam sterilizer is installed, the plant should be finally sterilized by steam. Corrosion is sometimes caused by using unsuitable well or bore water, and dairymen should endeavour to make provision for an adequate supply of rain water at the milking shed.

2. Old and pitted rubbers.—The remedial measures in this case are self evident.

3. Improperly cleansed coolers, cans, buckets, strainers, &c.—Particular emphasis must be placed on the milk cans as a possible source of contamination. Cans must be thoroughly clean and free from dents, rust spots, milkstone, open seams, &c. Milk is in contact with the can for a longer period than any other piece of equipment on the farm, and where milk is held overnight this may be up to 16 or 18 hours. Therefore, if the can is contaminated in the first place, a heavy build-up of bacteria takes place by the time the milk reaches the depot. Factory can-washing can hardly supersede the individual washing and sterilizing that should be carried out on the farm. Cans should be washed and sterilized immediately they are returned from the factory or depot and, before use, flushed out with a chlorine sterilizing solution. In some cases, higher counts of heat-resistant bacteria are found in the morning's milk than in the night's milk. This usually points to the "lick and a promise" clean-up after the evening milking, as practised by some producers.

It must be understood that the term "heat-resistant" is relative, for though heat-resistant bacteria withstand pasteurizing temperatures they are killed at boiling point unless they are capable of forming spores. They are susceptible also to chemical sterilizers such as chlorine. The important point is that they are not found on utensils properly cared for and properly cleansed and sterilized.

Control methods on the farm can be summarized as follows:—

1. Check all equipment for the presence of milkstone or corrosion and, if present, see that it is removed.

2. Meticulously carry out the cleansing and scalding methods at all times.

3. Before use, flush *all* utensils (machines, &c.) with a cold chlorine rinse. This rinse can then be used as an udder-wash, which not only reduces milk contamination but helps to keep down udder troubles, such as mastitis.

4. Cool all milk quickly and keep at as low a temperature as possible.

5. Reduce dust contamination as much as possible, particularly during milking operations.

6. Milk for the pasteurized trade should be delivered, if possible, twice daily with early and rapid delivery.

Because large sums of money are spent in advertising the food and health values of milk, producers are under an obligation to supply milk of the best quality. Only carefully produced milk deserves such favourable publicity.

Technical Assistance to the Cheese Industry.

IN his report for the year ended June 30th, 1946, the Director of Dairying (Mr. E. B. Rice) set out the following technical services which had been rendered by the Department to the cheese industry during the year. During the 12 months field officers made 130 visits to cheese factories, carried out 15,000 tests on milk supplies and factory processes, and visited hundreds of farms in connection with advisory work.

Bacteriophage Studies.

Starter failures due to bacteriophage continue to be a problem of cheese manufacture. Field officers have visited factories which have experienced slow vats and have recommended the following procedure in endeavouring to minimise "phage" infection:—

(*a*) Propagation of bulk starter in starter cabinets, preferably isolated from the cheesemaking room; starter cans to be fitted with "water-seal" lids.

(b) Rotation of starters daily, using several strains the phage for each of which is strain-specific and thus minimising the building-up of phage in the factory equipment.

(*c*) Intensive chlorination of factory equipment prior to use each day.

(*d*) Effective heating of whey.

An experimental isolated starter room erected at Yargullen factory is giving promising results in propagating single-strain starter free from phage infection. After some difficulty experienced in maintaining the temperature of this room in the hot weather, the ventilation system was modified with satisfactory results.

Mite Control.

Mite infestation of some cheese-holding rooms assumed serious proportions in the past year. Control measures so far tried have centred round improved curing-room hygiene, coupled with fumigation with formalin, sulphur, and ammonia. It is hoped to be able to carry out tests using dichlorethyl ether, which has recently been reported on favourably as an acaricide by New Zealand investigators.

Waxed Cheese.

Although waxing of cheese intended for export to Britain is not permitted under the terms of the Imperial contract, some cheese factories are still waxing cheese sold on the local market. Observations at factories

during the year indicated the desirability of a pre-drying period before waxing, and that waxed cheese requires holding in rooms the temperature and humidity of which are adequately controlled.

Milk Renovation.

Trials on partially reducing the acidity of milk of high acidity prior to pasteurization resulted in the production of cheese which was officially classified as first grade, while the unneutralized milk produced cheese of low second grade. The raising of cheese quality must, however, be approached primarily from the angle of improving the quality of milk rather than by attempting to renovate inferior milk, which can at best produce only a bare first-grade cheese.

Cheese Transport.

During last summer it was found that much of the cheese arriving in Brisbane from country factories was in an unsatisfactory condition when the wagons were opened up. At the request of the Cheese Board this problem was given much consideration and a report was subsequently made in which several recommendations were made. Despite the proper icing of the wagons before leaving Brisbane, it was easily shown by calculation that very little if any cooling of the cheese would result after loading at the factory. The loading of approximately 6 tons of uncooled cheese is far beyond the refrigeration available, as represented by the cool air of the wagon and the remaining unmelted ice combined. There is no easy solution of this problem, as the wagon is charged to capacity with ice and it is not possible to renew this at cheese factories, as no ice supplies are generally available locally. In any case, the time factor is against any effective cooling during transit, and, such being the case, deterioration in quality is very likely as control of both cheese temperature and the air humidity within the wagon is indeterminate. The logical conclusion was that the only satisfactory technique would be the proper cooling of cheese before leaving factories by the use of, preferably, air conditioning. With proper self-contained air-conditioning units, efficient control is easily practicable, the only difficulty being the installation costs. As a result, an alternative method using only standardized refrigeration equipment is being considered and it is hoped that, with proper technique, reasonably accurate control of humidity will also be obtained. Full arrangements have been made with the Irongate Co-operative Dairy Association to enable a proper investigation of this technique during the summer season.

Cheese from Homogenised Milk.

The investigations on the manufacture of cheese from homogenised milk were brought to a conclusion. Modifications in plant layout and treatment have simplified the technique. The following are comments by the Australian Dairy Produce Controller (Mr. C. Sheehy) on a sample examined by him in London during his recent visit to Britain:—

> "It was to my way of thinking as fine a flavoured cheese as ever I tasted. Messrs. J. Howey (Victoria) and A. Tuohy (London Manager, Australian Dairy Produce Board), who were with me when it was opened, were greatly impressed by its quality, which they agreed was delicious. You will be glad to know that there was only one tiny trace of fat on the outer paper, whilst the parchment wrapping also indicated a similarly small leakage of fat

for a cheese that had come from Australia to England through the tropics by way of ordinary parcel post. It was truly an amazing achievement, as the cheese on arrival was in every way in as good condition as one would expect to find associated with a similar cheese marketed locally in the ordinary way."

This product, which does not exude fat at temperatures over 100 deg. Fahr., is expected to prove very acceptable under tropical and sub-tropical conditions. The cheese matures much faster than ordinary cheddar cheese, yield of cheese per pound butterfat is higher, and fat losses in the whey are lower. The Queensland Butter Board has assisted materially in these investigations by way of the purchase of any necessary factory equipment, while the directorate and staff of the South Burnett Co-operative Dairy Association have placed every facility at the disposal of departmental officers responsible for the investigations. In conjunction with the Council for Scientific and Industrial Research and the Queensland Butter Board, attention is now being given to developing a method of improved packing of this product. The aim is to pack a consumer-size square package with special transparent covering.

Further observations on the addition of calcium chloride at the rate of 2 oz. per 100 gallons to milk pasteurized for cheesemaking have indicated its beneficial influence when milk of low casein and solids-not-fat content is being dealt with during periods of dry weather.

With a view to ascertaining if the physical condition of cheese might be improved, investigations were carried out in manufacturing cheese in accordance with a system recently reported to be successful in America. The main departure from normal procedure is in the low acidity developed at various stages of manufacture. The practicability of the method under Queensland conditions was demonstrated.

A STRAINER WHICH LASTS LONGER.

The wire gauze commonly used in farm milk strainers has been in short supply for some time, and, consequently, in many strainers it is in such poor repair as to make efficient straining impracticable.

The elimination of the gauze and its replacement by a flat, perforated, tinned-steel or stainless-steel disc is equally as effective in straining milk as the gauze, and the disc lasts longer and is more easily cleaned. The strainer is assembled in the usual way—the convex, perforated disc on top, then the cotton wool filter pad, and the flat, perforated disc on the bottom. The perforations in the flat disc should be somewhat smaller and more numerous than those in the convex disc. Although sturdier and more hygienic than gauze, the steel disc is of no use for straining milk without the cotton wool filter pad. This, however, is in no way a disadvantage, as it guards against the temptation to omit the filter pad and partly strain milk by using only the gauze.

—H. W. JENYNS, Dairy Officer.

ANIMAL HEALTH

Contagious Pneumonia and Paratyphoid of Pigs.

A. K. SUTHERLAND, Veterinary Officer, Animal Health Station, Yeerongpilly.

CONTAGIOUS pneumonia is one of the commonest diseases of pigs in Queensland. It is caused by a specific bacterium, *Salmonella cholerae suis* (sometimes called *S. suipestifer* or *Bacillus suipestifer*). This organism may cause three types of clinical symptoms in pigs, namely, paratyphoid, necrotic enteritis and contagious pneumonia.

When the disease runs an acute (septicæmic) course, it is called paratyphoid; when the bowel is the principal site of lesions it is known as necrotic enteritis; and when pneumonic symptoms are shown it is contagious pneumonia. Thus it is important to remember that the one organism may cause three types of disease.

Contagious pneumonia and paratyphoid are very common in pigs 3 to 4 months of age. In Queensland, necrotic enteritis is rare, but mild lesions of the bowel are often present in cases in which pneumonia is the principal manifestation of the infection.

Economic Loss.

Many pigs may die during an outbreak of paratyphoid, particularly in large fattening establishments.

Contagious pneumonia also causes many deaths, and pigs which recover are often unthrifty or worthless. When the disease appears in pigs near market weight, some fatteners attempt to reduce their loss by forwarding the whole of the affected mob for slaughter; in such cases, there are often many deaths en route to the bacon factory and in the yards while awaiting slaughter. Furthermore, many carcases from such a mob may be condemned for paratyphoid, fever or septicæmia.

The aggregate financial loss from contagious pneumonia and paratyphoid is obviously heavy, because both these diseases are prevalent throughout the pig raising districts of Queensland.

Symptoms.

Paratyphoid.—Serious symptoms may develop in a few hours. There is marked dullness and no inclination to move even when hunted. Appetite is lost, but there may be considerable thirst. There is fever (temperature 104° to 107°) with a red or purplish discoloration of the skin of the belly. Death occurs within a few hours or a few days. Often pigs are simply found dead without having been observed sick.

Post mortem examination may reveal little to the unskilled observer. The blood vessels of the carcase are often congested. Lymph nodes throughout the body are usually swollen, juicy, and dark reddish purple,

with many pin-point hæmorrhages in their interior. Quite frequently there are pin-point hæmorrhages beneath the capsule of the kidney. The spleen may be somewhat soft and slightly enlarged. The lungs are usually dark red and the early stages of pneumonia, as described in the next section, may be present.

Contagious Pneumonia.—The main symptoms in this form of the disease are fever and pneumonia. Affected pigs are dull and disinclined to move. They are usually thirsty, but have poor appetites. There is a cough, rapid, shallow breathing and a thick discharge from the eyes and nose. The pigs lose weight rapidly and become very weak and may stagger. Death may occur in one to two weeks after the appearance of the symptoms.

Less severe cases of pneumonia may recover, particularly if well fed and cared for, but more often they remain unthrifty. Animals which recover may eat so much feed before they are marketed that they are unprofitable by the time they are ready for the meat works.

Post mortem examination shows marked lesions (pneumonia) in the lungs. The lung tissue has lost its normal salmon-pink colour and spongy texture. It is firmer than normal and does not float in water. The colour varies from dark red to light grey. There may be an excessive amount of fluid in the chest cavity and in the sac surrounding the heart. The lungs may adhere to the chest wall by fibrous strands, and within the lung tissue there are usually many small abscesses containing greyish-yellow pus. Those who are familiar with meat inspection will observe that the bronchial lymph nodes are swollen and juicy.

Changes similar to those seen in paratyphoid may occur in other organs.

Necrotic Enteritis.—In the early stages there is fever, loss of appetite and dullness. Diarrhœa soon appears and the pig loses weight rapidly. Some pigs become very weak and die from one to several weeks after the appearance of symptoms; others make a gradual recovery, but fatten slowly.

Post mortem examination reveals lesions in the intestine usually in the cæcum or blind gut and adjacent parts of the large bowel. The wall of the bowel is thickened; its internal lining is reddened and congested, and may be ulcerated or covered with either large patches or many small "buttons" of brown, grey or yellow scab-like material.

Sources of Infection.

Pigs which recover either completely or partially from any form of the disease may harbour Salmonella bacteria for long periods. Such animals are called "carriers". They discharge infective material in their dung or urine or in sputum coughed up from the lungs. Salmonella infection is so common among pigs that "carriers" are always likely to be present in a batch of purchased stores. Thus breeders should avoid purchasing pigs if there are any in the batch with a cough or diarrhœa. Likewise, they should avoid buying from herds in which these symptoms are evident.

The Salmonella bacteria are not very hardy and soon die when exposed to sunlight and dryness. Unfortunately, however, many piggeries have moist shaded places in which the micro-organisms can survive for many months. Every batch of pigs housed in sties or yards of this type is exposed to the risk of infection.

Uncooked pork scraps or butchers' offal may introduce contagious pneumonia and other infectious diseases into piggeries, therefore *The Diseases in Stock Act* requires that all offal and garbage fed to pigs shall be thoroughly boiled.

Conditions Which Predispose Pigs to Infection.

A number of factors lower the pigs' resistance to disease.*

Outbreaks of pneumonia and paratyphoid will occasionally occur in herds kept under the best conditions, but these diseases are most troublesome in herds kept in unhygienic quarters. Low lying, muddy or "pig sick" yards, dirty pig wallows, and old wooden sties, which it is impossible to clean or disinfect, all predispose a herd to outbreaks of contagious pneumonia. It will be readily appreciated that when infection is introduced into premises on which insanitary conditions prevail, the yards, troughs and sties soon become loaded with disease germs. Overcrowding also predisposes the herd to infection.

Well fed and rapidly growing pigs have greater resistance to disease than animals suffering from malnutrition. Nevertheless, even strong, well nourished animals may succumb and, in fact, one frequently sees fat pigs which have died from paratyphoid.

Rations which are deficient in protein, with respect to either quantity or quality, or in vitamins, reduce the pig's ability to resist infectious disease. Hence, it is wise to use a well balanced ration. Green feed is particularly important to ensure a supply of vitamins, and if good pasture is not available, then good quality lucerne chaff should be fed.

Herds which are maintained by buying stores are in constant danger of becoming infected through the purchase of "carrier" or diseased pigs.

Diagnosis of Contagious Pneumonia.

When outbreaks of disease occur, pig raisers should consult the nearest veterinary officer or stock inspector to obtain an accurate diagnosis.

Sucking pigs are rarely affected with contagious pneumonia. The harsh dry cough which is often observed in suckers a few weeks old is usually caused by the larvæ of the large roundworm, *Ascaris lumbricoides*, migrating through the lungs.

Swine influenza apparently also occurs in suckers in Queensland. This disease produces pneumonia with cough, a discharge from the eyes and nose and perhaps sneezing.

Pneumonia in weaned pigs is usually contagious pneumonia caused by *Salmonella choleræ suis*.

Diagnosis of Paratyphoid.

This disease often kills quickly and leads the farmer to suspect that the pigs have been poisoned. A short, fatal illness accompanied by reddish purple discoloration of the skin of the belly and the ears, swollen, watery, dark-red or purple lymph glands and tiny hæmorrhages in the kidneys, would lead one to suspect paratyphoid. If the lungs show

* See also A. L. Clay (1946) "Management of Pigs in Relation to Disease Prevention". *Queensland Agricultural Journal*, February, 1946.

some signs of pneumonia, or if there are necrotic ulcers in the blind gut (cæcum), then a diagnosis of paratyphoid is strengthened. Officers of the Department of Agriculture and Stock can submit appropriate specimens to one of the Animal Health Stations for confirmation of their diagnosis.

Swine paratyphoid has to be differentiated from:—

(1) *Nitrite poisoning* in which the characteristic feature is a brownish discoloration of the blood.

(2) *Acute swine erysipelas.* The septicæmic form of erysipelas resembles paratyphoid and laboratory examination is necessary to differentiate the two diseases with certainty. Pneumonia may be present in paratyphoid, but not in erysipelas.

(3) *Arsenical poisoning* produces abdominal pain and diarrhœa and usually results in death fairly quickly. The stomach and intestines are acutely inflamed and hæmorrhagic.

(4) *Swine Fever.*—The disease known in Great Britain as swine fever and in America as hog cholera is similar to paratyphoid. Swine fever does not exist in Australia, but on three (or perhaps four) occasions it has been introduced into this country in imported pigmeats. The last outbreak occurred in 1943 near Sydney, New South Wales, and was quickly stamped out by quarantine and slaughter of affected pigs.

It is important, therefore, that any outbreaks of swine fever be promptly detected and dealt with. The symptoms and post mortem findings in swine fever are similar to those described for paratyphoid, but swine fever should be suspected if the outbreak spreads rapidly through the piggery and has a high death rate. The two diseases can be differentiated only by laboratory tests, so it is necessary to seek competent advice at once, so that appropriate specimens can be submitted to the laboratory.

How to Deal With an Outbreak.

There is no efficient medicinal treatment at present available for contagious pneumonia or paratyphoid. Therefore, to minimize losses when the disease occurs the following action should be taken:—

1. Isolate all sick pigs, preferably by moving the healthy pigs to new quarters. If only one pen on a piggery is affected then the whole of this pen should be held in quarantine and the remainder of the herd removed from contact with them, e.g. by vacating adjoining pens or yards.

2. Destroy seriously affected pigs and burn or bury the carcases.

3. Infected dung and discharges should be dealt with by removing all litter and rubbish from pens and burying it or disposing of it so that it is not accessible to pigs. Troughs, other than of metal or concrete, which cannot be disinfected, should be burned.

4. All wet or muddy places or wallows in pens should be either drained or filled in.

5. Sunlight is an excellent disinfectant. It may be necessary to lift the roofs of sheds and to lop trees to admit sunlight to sties and yards. Chemical disinfectants are not reliable except on clean metal or concrete surfaces, because they do not penetrate into cracks, soil or organic matter to kill germs lodged in such places.

6. All pigs in contact with diseased pigs should be held in quarantine and sold for slaughter as soon as possible.

7. Sows with litters should be strictly isolated to protect them from infection. Weaners should run with others of their own age and *not* with a mixed mob of older pigs in which there are bound to be some carriers.

Prevention.

In herds which are maintained by purchase of stores it is difficult to avoid infection, so they should be worked with this risk in mind.

To prevent infection, it is therefore necessary that the pig raiser breed his own pigs. The breeding stock to establish a disease-free herd should come from a piggery in which there is no evidence of infection. Once a clean herd is established it must be kept clean by avoiding either direct or indirect contact with other piggeries which are possibly infected. If garbage or offal is fed it must be thoroughly boiled.

Pigs showing a cough, discharge from the eyes or nose or diarrhœa are very likely to be carriers of contagious pneumonia or paratyphoid, although they may appear to be in good condition. Unthrifty pigs should never be purchased. Pigs in contact with pigs showing any of these symptoms are also likely to be carriers.

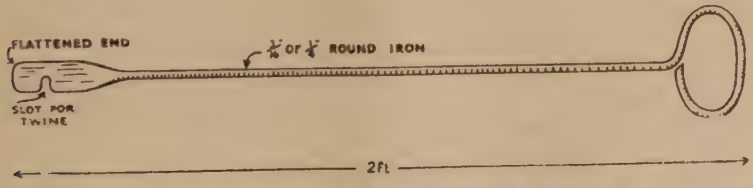
Vaccines for paratyphoid and pneumonia in swine are marketed under a variety of names, e.g. swine plague vaccine, suipestifer vaccine, contagious pneumonia vaccine, but they are not effective in preventing the disease.

It will be apparent from the discussion on predisposing factors that good feeding and sanitation are important. Losses caused by pneumonia and paratyphoid are lowest in herds grazed on well managed pasture and fed in either clean metal or concrete troughs or from clean dry self-feeding hoppers.

DEVICE FOR TYING HAY BALES WITH TWINE.

During the past few years baling wire has become increasingly difficult to obtain, with the result that much of the baled hay crops had to be tied with twine. To meet this position on his stationary hay baler, Mr. J. V. Hardy, who is farming in the Paeroa district, made a device for threading the twine through the bales.

It consists of a rod with a loop forming a handle at one end. The other end was flattened after being heated, and a slot to take twine was cut into one side. The over-all length of the device is about 2 ft.



The twine is placed in the slot, the rod pushed through the compressed hay near one block, and the twine pulled through. The rod is withdrawn and inserted near the next block, where the twine is again placed in the slot and drawn through to the side from which the operation was started. Finally the twine is drawn tight and tied. This operation is carried out for both top and bottom ties, a separate ball of twine being used for each.

The device is simple but effective, and Mr. Hardy has consented to the publication of this note in the hope that it will be helpful to other farmers.—C. Walker, Instructor in Agriculture, Thames (N.Z.), in the *New Zealand Journal of Agriculture*.

Housing of Poultry.

T. HALLICK, Inspector, Poultry Branch.

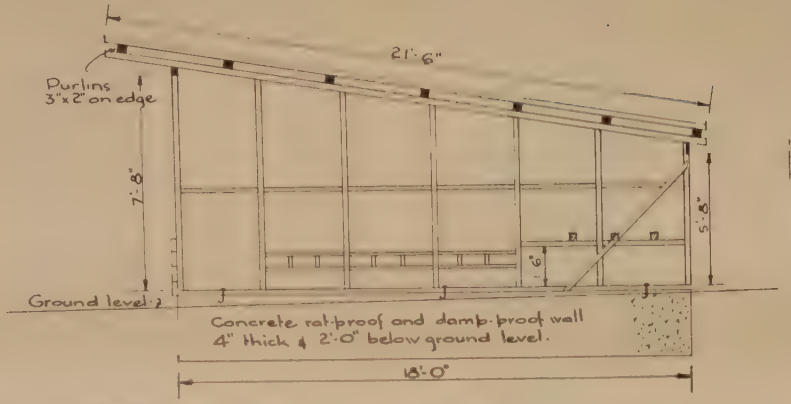
IN the consideration of housing of poultry, many factors have to be taken into account, location, climatic conditions, suitability and availability of materials, and cost of construction being of major importance.

There has been a tendency in some instances to proceed along lines of housing shown in overseas publications. These, whilst admirably suited for their countries of origin which suffer from severe conditions of wet and cold, may not be as suited to the requirements of our more tropical conditions. Poultry sheds of the log cabin type, totally walled on all sides, have no place in our State, having been designed primarily to conserve heat, whereas the objective in most instances in Queensland is to provide satisfactory shelter from rain and direct winds, whilst still securing the utmost circulation of cool fresh air around the birds. In planning a good poultry house adequate protection to the fowl must be given not only against the most biting of winds, which usually come from a west or south-westerly direction, but also against the summer heat, for excessive cold or heat can seriously affect the egg yield from the flock.

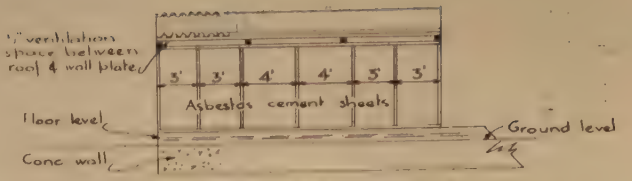
Correct ventilation is essential to disperse the moisture given off by the birds in breathing and from the droppings deposited below the perches. A moist atmosphere conduces to the spread of roup, the greatest of all poultry scourges. The average shed in use in this State, whilst giving plenty of air from the front and over the top of the birds, generally fails to provide any ingress for fresh air below the perches, thereby creating an area of damp, stagnant air under the birds. Provision should therefore always be made for the passage of a current of outside air through the bottom of the back wall, but baffled in such a manner that a direct draught is not set up.

The shed should be designed to utilize to the fullest the valuable properties of sunlight, whilst giving protection from overheating. A high open front facing in the correct direction will permit of the sunshine passing over the whole of the floor space at different times of the day, thereby drying out the droppings and, where the birds are kept intensively, providing a large percentage of "sunshine vitamins" so necessary to their health. A good height of front to the shed will also reduce heat radiation in hot weather, and this can be further controlled by the use of cooling paints upon the roofing material.

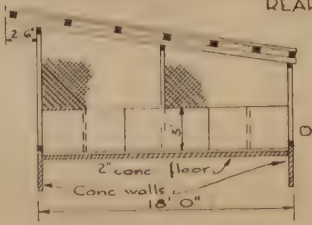
DETAILS OF POULTRY HOUSE



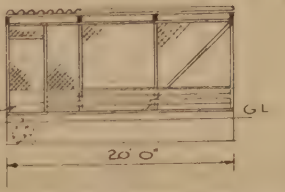
CROSS SECTION



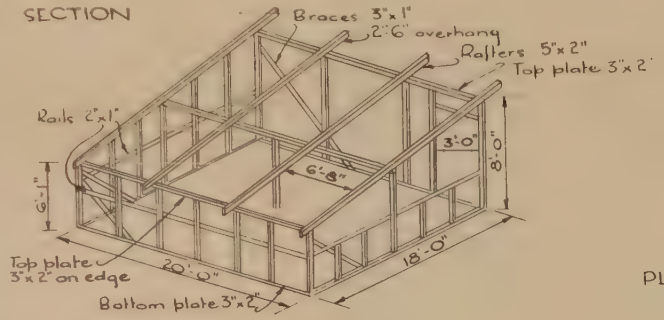
REAR ELEVATION



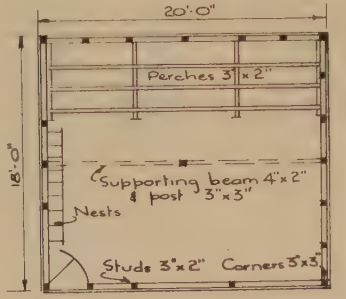
END ELEVATION



FRONT ELEVATION



FRAMING DETAILS



PLAN

Plate 35.

SITE.

The first point to be considered is the site upon which the housing is to be erected. Whilst practically any aspect or slope may be utilized for poultry keeping, bad gradients or faulty aspect may seriously increase the capital cost of shed installation, due to necessary correction of such faults.

Too severe a slope will necessitate the digging out and hilling up of areas to provide the essential of level floor spaces; alternatively, if wooden floors are utilized, they will have to be placed upon stumps in such a manner that one side of the shed will be greatly above the ground level, and extra labour will be involved in carrying feed, etc., up stairs or ramps. The force of storm waters down a severe slope will also tend to break down any but the best of drains, with resultant flooding of the fowl house floor. A wrong aspect makes it particularly difficult to provide protection from cold winds and driving rain and at the same time give ample open wall space for the admission of the maximum amount of sunlight.

It will be obvious that, if a steep slope with a westerly aspect is chosen, the wall of the house facing the west should be completely closed to protect the birds from driving westerly winds, and the open side of the shed on the east shaded from the morning sun. Conversely, it will be noted that an easterly or north-easterly aspect not only gives the greatest degree of sunlight but also provides some degree of natural protection from the westerly winds. The ideal site is a gentle slope with an easterly, north-easterly, or northerly aspect, and it has been found by experience that the facing of open-fronted sheds towards the north-east gives the greatest degree of protection against driving rains in most localities.

Soil Type.

Poultry farming is successfully carried out on all types of soil, but for semi-intensive housing soil of a sandy nature is preferable, for it preserves the cleanliness of the runs to a great extent, due to the constant disintegration of excreta, as the sandy soil is scratched up by the birds. Soil of a clayey nature tends to harden on the surface during dry spells, and excreta become plastered upon it; in wet weather it "puddles," and miniature cesspools are created from which the birds will drink, to the detriment of their health. Hard rocky soils are not only troublesome for the attendant to work, but also cause cankerous growths upon the feet of the birds due to stone bruises.

TYPES OF HOUSING.

There are three generally accepted practices for poultry housing:—

(1) Intensive,

(2) Semi-intensive (house and yard),

(3) Free or open range.

1. Intensive Housing.

Under this system of housing, the birds are kept entirely under cover in fairly large sheds, and in relatively large numbers. Therefore, strict attention has to be paid to the physical condition of the bird, and to the question of feeding. As the bird has only a very restricted space, 4 sq. ft. per bird being about the correct area, exercise has to be

promoted to ensure the health of the birds. This is done by having scratching material or litter, such as grass, straw, leaves, or chips, strewn over the floor to a depth of 4 to 6 inches, all the grain portion of the ration being scattered in it. This naturally promotes a good deal of scratching on the part of the bird in search of grains that have become covered, and it should be obvious to all poultry raisers that the feeding of the evening grain should not be left until towards the end of the day. Many farmers allow a wide range to their birds, consequently they gather a fair amount of natural food and so do not consume as much feed as birds kept entirely under cover. If at any time poultry breeders keeping birds under such conditions think it desirable to change over to the intensive system, because of the damage done by their poultry to crops, haystacks, or gardens, the question of feeding becomes

Plate 36.

Intensive Poultry House in Course of Construction.—Note concrete baffle wall to prevent rats making home under floor.

very important; in fact, any person keeping poultry under these conditions must give this matter the utmost consideration, as it is impossible for the birds to procure anything but what they are supplied with. The failure of many poultry farmers to appreciate this point has caused this system of housing to be condemned.

2. Semi-intensive Housing.

This system is merely the addition of small netted yards to the intensive house, thereby increasing the carrying capacity per square foot of housing (only 3 sq. ft. of actual roofing per bird being required). This method cuts down capital cost and may be of value to a beginner who has to quickly bring his flock number to a total sufficient to provide a living income with a minimum outlay of original capital. This method has the

disadvantage of the free range system, inasmuch as the birds are liable to be affected by contact with outside climatic changes, to the probable detriment of health and egg production. Soil contamination is another serious defect; however, on loose sandy soils this is held to a minimum. As with the intensive system, all birds are under control at all times and can be securely fastened at night or when required for attention.

3. Free or Open Range Housing.

On this system, the movement of the fowl is not confined in any way, and although some contamination of soil will be caused it does not become serious because of the unrestricted range and growth of plants.

As only a small shelter shed is provided for roosting purposes, the birds are exposed to the vagaries of the weather, with unstable egg production. The system is hazardous in any district where foxes abound, and losses of over 100 birds in one night have been caused by this pest.

Most Suitable Type of Laying Sheds.

Any type of shed is suitable for housing of poultry, provided the points previously enumerated with regard to provision being made for correct entry of sunlight and adequate ventilation are closely followed, and existing buildings can be adapted along these lines.

The ideal laying shed for Queensland, when ease of management, economic coverage of birds, and greatest use of sunshine is aimed at, is one from 18 to 20 ft. in depth from front to back, with a height of 8 ft. at the front and 6 ft. at the back wall. This shed can be of indefinite length, but if in excess of 20 ft. should be divided into 20 ft. sections; these sections will carry 100 birds if run intensively, or 140 semi-intensively, by the provision of a netted yard of similar dimensions.

Plate 35 shows the cross section of such a shed, which has a veranda commencing just under the rafters in front. This veranda prevents rain beating into the house from the front, and by not extending right to the top of the roof allows a free circulation of air. If desired, the roof may be extended by 3 ft. instead, but in that case the height of the shed in front may be 8 ft. The back wall of the shed should be divided into three sections: a solid wall commencing 12 inches above ground level, and terminating 12 inches below the roof, and 12-inch flaps hinged to top and bottom of this fixed wall. The upper flap, opening upward and outward and hinged to the top batten, will provide a regulated amount of top ventilation, and the lower flap, opening upward and outward, a regulated amount of ventilation below perches. The space below perches should be separated from the general floor space by the provision of 4-inch mesh netting slung immediately below the perches, and extending from the front of the perch to the floor of the shed. In this manner the greater part of the birds' droppings will be prevented from contaminating the scratching litter on the shed floor, and by completely opening the bottom flap of the rear wall can be easily removed for sale, or use in farm cultivation, without any disturbance of the fowls.

Side walls, and the lower front wall, to a height of 2 ft. from floor level, should be of solid material; the balance of the front wall is of wire netting. In intensive sheds the front solid section of wall may be modified by the installation of nest boxes along its upper half, the back of the boxes being accessible from the outside of the shed. If dry mash hoppers are placed upon the front wall above the nest boxes, with water

troughs at ground level on the outside front, and openings in wall for poultry to protrude their heads to obtain a drink, entrance to the shed by the attendant will be reduced to the minimum with a considerable saving in time and labour to the farmer.

If these sheds are used with the semi-intensive system, the yards will have to be placed at the rear of the houses, with trapdoors in the rear walls for passage of fowls; as it is essential, if the maximum benefit is to be obtained from such a shed front layout, that a clear roadway is available along the front of the sheds for passage of vehicles used in feed replenishing operations, and a multiplicity of yard gates will considerably add to the labour of egg collection and other work along the sheds.

Plate 37.

INTENSIVE LAYING SHEDS COMPLETED.

The most common adaptation of poultry housing met with to-day are the huts removed from Army camps. These huts are generally from 16 to 20 feet wide, and feature in the main a gable roof; when correctly converted they make excellent intensive sheds. If possible the spacing should be increased where the roofing sheets meet at the top of the gable, and provision made for a free passage of air through this section, care being taken to enlarge the ridge capping sufficiently to afford ample protection from driving rain.

The side of shed facing east, north-east, or north should then be modified in accordance with that described for the "lean-to" shed illustrated in Plate 38, and the reverse side can be altered very easily to provide the solid centre wall with flap extensions at top and bottom.

Building Materials.

Any standard type of building material may be used, from cemented hessian to brick and concrete, and the farmer should be guided in his choice by the local conditions of availability and cost.

Cemented hessian is probably the cheapest form of building material, hessian being tightly tacked to the framework of the shed and then coated, whilst wet, with cement. Directions can be obtained from the Department for its correct application, but it is not suitable for roofing, and some more durable and waterproof material must be provided for that section. Whilst cemented hessian will give a cheap and fairly satisfactory job, it is not recommended, as it is very easily damaged and will always be found troublesome at its lower edges, the fowls having a tendency to peck it away from the battens and studs.

Brick and concrete are, of course, ideal when considered from the point of insulation, giving maximum protection from both heat and cold. Their cost, however, generally militates against their use, and they have the decided disadvantage of being permanently positioned, making alterations to plant layout very difficult.

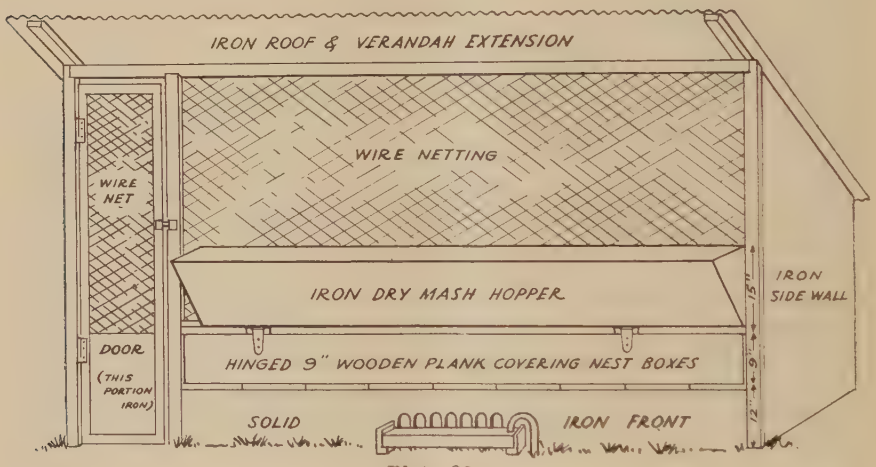


Plate 38.
Front of a fowlhouse, showing floor-level water system with nests and dry-mash hopper above.

Sawn hardwood timber has been used in the southern States successfully for many years, and where used with a wooden roof covered with roofing felt a fair stability of temperature is ensured. Timber buildings, however, have a decided disadvantage in the fact that, unless constantly and effectively treated with deterrent oils or creosoté, they are liable to afford harbourage for parasitical vermin of the tick and mite types.

Galvanized iron and asbestos cement sheets are probably the most suitable materials available in this State. Used in conjunction with a sawn hardwood timber framing they combine the virtues of cheapness, easy conveyance to site, minimum labour of erection, clean and sanitary walls with little chance of vermin harbourage, and maximum length of life. They may also be dismantled and re-erected, should it ever be

required, with little loss from damage. Asbestos cement sheets, being naturally white in colour, radiate the heat of the sun, and do not become excessively hot, but galvanized iron can be improved by painting with one of the cooling paints prepared for this purpose.

Floors.

It is essential that flooring of poultry sheds should be as hard as possible, for any looseness will be quickly dug into by the birds, thereby making it impossible to completely remove excreta from sheds without removal also of portion of the floor surface. For this reason earthen floors are generally unsatisfactory, although a fair degree of hardness can be obtained with "puddled" clay. Cracks and crevices will eventually appear in any earthen floor, and these become excellent breeding grounds for many types of parasites, such as worms and fleas, as well as propagating the many disease organisms which are passed in the excreta. Nothing can be so dangerous to the health of the fowls as wet or damp earthen floors.

A few years ago a trial was made of the application of bitumen covering over hard-tamped earth floors, but insufficient information is available to enable a definite opinion to be given of its merit; in some known cases, however, it was found that the scratching proclivity of the birds triumphed, and the bitumen was broken up at the wall edges.

Hardwood flooring is satisfactory, and where the sheds are built on a fair to severe slope the most economical in installation; no filling or levelling of ground is required, stumps equalizing varying ground levels. Timber floors are easily cleaned, but must be well treated at regular intervals with oil or creosote to minimise the risk of vermin infection.

Concrete flooring is probably the ideal, giving a perfectly hard, smooth surface, unaffected by scratching and repellant to vermin. It is easy to clean, and can be hosed down if necessary. It is essential, however, that it be perfectly constructed and that the edges of the floor be carried down into the ground all round to a depth of at least 24 inches, otherwise rats will work under the floor, eventually undermining it to such an extent that the surface will crack and break. Concrete flooring shares with concrete and brick sheds the disadvantage of being a fixture; if the shed has to be removed a new floor has to be provided.

Brooder Sheds.

Houses for the brooding of chicks will naturally vary according to the type of brooding equipment installed.

Battery Brooding.

For battery brooding, any well insulated room is suitable, provided it gives ample head room and has sufficient opening windows to supply adequate light for attention to brooders and ventilation to the room. It is not practicable to endeavour to supply direct sunlight to all chicks in an average type of commercial battery brooder, and for this reason there is no necessity to use open fronted sheds, the absence of sunlight being made up to the chicks by fish oil supplements in their diet.

Cold and Hot Brooding.

A shed of similar construction to that detailed for laying hens will be found satisfactory for most other types of brooding, but may be reduced to a depth of from 12 to 15 ft. from front to back; the rear 3 ft.

of floor space should be partitioned off to a height of 2ft. with solid walling, and thence to roof with 1-inch wire netting, to provide a through passage from end to end of shed, and the shed doors placed at the ends of passage.

When cold brooders are used, the shed should be further partitioned into sections 6 ft. wide, running from the front of the shed to the interior passage wall; each of these sections should house a cold brooder of 100-chick capacity.

Where heated brooders are used the spacing between sections will have to be altered to suit the known capacity of the brooder. For instance, oil or electric hover brooders of 300-chick capacity will require the partitions to be approximately 12 ft. apart, the brooder being placed in the centre of the sectional floor.

Brooder House Fronts.

If open wire netting fronts are to be utilized, the lower front should be of solid construction to a height of 3 ft. from the ground, the balance of the front being netted with ½-inch mesh wire, and flaps of iron, timber, or hessian should be provided which can be closed over the open netting front as protection against inclement weather conditions.

The most suitable brooder house front, however, has glass windows substituted for the open netted space. These windows should be hinged in such a manner that, when conditions are favourable, sunshine may pass over the shed floors without contact with the glass windows, for window glass, whilst admitting light, is impervious to the sun's ultra-violet rays, which are particularly beneficial to the chicks. Window glass substitutes, manufactured from stiffened, waterproof fabric materials, do not suffer from this disability, but prove costly, due to their comparatively short life in normal use.

Weaning Sheds.

It is customary to provide an intermediate type of housing for chickens between the ages of 6 weeks and 4 months, to cover the period after leaving the brooders and prior to installation in their permanent laying quarters.

Intensive System.

Where weaning is carried out on the intensive system, sheds of similar type to those described for laying hens should be provided, but the overall measurements may be reduced to a depth of 12 ft., with height of 7 ft. and 5 ft. at front and back respectively. The lower ventilation flap at the back should be reduced to a width of 6 inches, as it will be necessary to have perching ramps installed within 12 inches of the floor for the first few weeks of the chicks' occupation.

Carrier battens should be placed on both side walls of the shed approximately 10 inches from ground level; 3 x 1 inch perches, extending the length of the shed, are placed on these carrier battens (intermediate carrier battens are placed at regular intervals to carry the weight of perches between the two battens on the end walls).

Commencing from the back wall, perches are spaced with intervals of 1 inch; when sufficient perches have been provided, a slatted ramp of the same materials should be extended from the front perch to the floor, at such an angle as to give chicks easy ascent to perches. As chicks become accustomed to sleeping on perches, spacing between perches may be gradually increased.

If chicks are placed in the weaning shed in cold weather, it is advisable to provide a canopy of hessian over the chicks, about 6 inches above the level of the perches. Bottom ventilation of the shed should be used very sparingly for the first month. It is better to have too little or no bottom ventilation than too much, until such time as the chicks are thoroughly hardened off.

The carrying capacity of this shed may be increased to 140 chicks if run semi-intensively, by the addition of netted runs.

Free and Open Range.

Where chicks can be reared under free range conditions, or in very large netted runs, they may be housed in units of 50, in sheds 10 ft. x 10 ft., 6 ft. high at the front and 4 ft. at the back. These sheds can be made with slatted wood floors of 3 x 1 timber, placed 12 inches from ground level. As with the batten system of perching, described for the intensive sheds, these floor battens should be movable, and from an original spacing of 1 inch apart they are gradually increased to the spacing of 12 inches apart, this flooring then becoming the orthodox type of perching.

Night Arks.

Night arks, which are very popular in England, are a simple and inexpensive modification of the foregoing shed.

Two light frame walls, covered with iron, asbestos sheeting, or roofing felt, each 6 ft. square, are fastened together at the tops with hinges or wire, and the bottom ends extended from each other to a width of approximately 5 ft. at the base. A slatted floor section frame, covered with 1-inch wire netting, is then inserted on runners placed on either side wall 14 inches from the ground, thus making a triangular shaped canopy shed, with a wire floor 12 inches above the ground. The rear end is closed in with solid material to within 12 inches of the top to form a windbreak, and the front end is wire netted, with a wire netted door. Such arks will carry 25 pullets to 4 months, are economical of manufacture, and can be easily dismantled for removal to a fresh site.

Incubator Rooms.

The requirements of a good incubator room may be summarized as under:—

1. *Good insulation.*—It is desirable that the temperature in the incubator room be maintained as far as possible within the range of 65 to 75 deg. F., and this necessitates the utmost regard for the insulating of the room. Brick or concrete are the ideal materials, with terra-cotta roofing tiles. A good job can be made, however, with asbestos cement or sawn timber for external walls, roofed with corrugated asbestos sheets.

The room should be lined with asbestos cement sheets to a height of 2 ft. from the floor, and with wallboard for the balance of the space to the ceiling. Wallboard used for the ceiling will also provide the maximum of insulation.

A veranda extension of the roof, especially on that side of the room which receives the afternoon sun, will reduce the temperature by several degrees, and the covered space afforded by the roof extension will be found useful in many respects.

2. *Ventilation.*—This is important, and can be effectively obtained in conjunction with good natural lighting by the provision of ample glassed windows of the casement type. In addition, openings fitted with efficient shutters should be inserted in the top and the bottom corners of all walls, about 6 inches from the ceiling and floor levels respectively. Size of openings will vary with the cubic capacity of the incubator room, and may be from 6 x 3 inches in a room 10 ft. square to 24 x 6 inches in a room of 40 ft. x 20 ft.

These wall ventilators will ensure the movement of stagnant air and gases from the floor of the room, even though the windows have to be kept closed during bad weather. Ten feet is a good height between floor and ceiling.

3. *Sanitation and Cleanliness.*—Every facility should be provided for quick and efficient cleansing of the room, for the removal of a large batch of chicks and subsequent cleansing of incubators is a messy job, and has to be done within a few hours if incubators are to be re-set to schedule.

There is only one satisfactory flooring material for an incubator room, and that is concrete. The floor should be sloped gently towards a drain, and a water faucet and hose installed within the room; the room can then be efficiently hosed and swept clean with a minimum of time and labour.

4. *Ample Working Space.*—The space around machines should not be restricted, for in addition to causing a possible shortage of oxygen, so necessary to good hatching results, a cramped area not only reduces the efficiency of the operator but in many cases is the indirect cause of loss through egg breakages.

5. *Fittings.*—A strong work bench is an essential fitting, and sufficient shelves or racks should be provided to accommodate all egg trays that have to be filled at one setting of machines; efficient artificial lighting must be suitably installed for night working and testing of eggs.

Feed Shed.

The feed shed should be built in some suitable position adjacent to the sheds, and should be fitted with sufficient rat-proof bins to hold a month's food supply.

A wooden floor built on stumps to the level of the motor truck body makes for ease of unloading supplies. Rats and mice having a tendency to breed around a feed shed, the system recommended in many overseas publications of building the feed shed as one section of the laying sheds does not appear wise; for vermin will have unrestricted run of rafters between feed and laying sections. If the feed shed is isolated, dogs or cats will eliminate vermin as they leave the feed shed to look for water.

RADIO TALKS TO FARMERS
(Australian Broadcasting Commission)
4QR AND REGIONAL STATIONS
THE COUNTRY HOUR—Daily from 12.15 to 1.15 p.m.
THE COUNTRYMAN'S SESSION—Every Sunday at 9 a.m.

Summer School for Young Farmers.

SIXTY boys attending Rural Schools in different parts of the State were selected to form the first agricultural summer school under the aegis of the Department of Public Instruction, and which was held in January at the Queensland Agricultural High School and College, Lawes. Under the leadership of Mr. J. P. Kahler, School Project Club Organizer, the school was an unqualified success. Of the boys attending the course, many were members or had been members of school project clubs and most of them were from farm homes.

For practical instruction, three groups were formed and later welded into evenly matched teams among whom a healthy sporting spirit was developed. Each week group leaders were elected by the boys, subject to recall if they proved unable to attain the high standard of leadership set. To the group leaders was allotted the task of introducing the groups to lecturers and demonstrators, acting as spokesmen on necessary occasions and as sports captains during their week of duty, and maintaining the cohesion of the groups on educational tours.

The programme was so arranged as to give the boys some training in thinking about the various jobs they may have to do in their home environment, basing action on rule of reason rather than rule of thumb. With appropriate breaks, lectures were set for the mornings and practical instruction for the afternoons. Ample provision for recreation was made by the Physical Education Branch, and which included swimming, gymnastics, and ball games.

A series of excellent techni-colour films lent by the Australian Wool Board and the International Harvester Company provided appropriate backgrounds to the lecture courses.

Lecture subjects included the following:—Some Ideas on Physics applied to Farm and Garden; Microbes on the Farm; Plant Pests and Diseases; Judging Livestock; Housing Systems; Poultry Farming; Irrigation; Dairy Practice; Horticulture; Tillage and Fertility; Principles of Crop and Animal Husbandry; Beekeeping; Elementary Forestry; and The Home Garden.

Outstanding events included visits to the Animal Health Station at Yeerongpilly and to the Department of Agriculture and Stock. At Yeerongpilly, practical demonstrations in simple veterinary practice were staged. At the Department, the boys were marshalled in two groups and were received in turn in the several laboratories where they saw in actual operation some of the methods by which science is applied to agriculture.

The boys displayed intelligence and keen interest in all they saw and heard. To some, perhaps, the quick movement from laboratory to laboratory and from subject to subject was, perhaps, rather bewildering, but from casual conversations during their rest and luncheon periods it was obvious that their general impressions of departmental services and facilities were sound and probably lasting. As representatives of country schools in the agricultural districts of Queensland, the young farmers had evidently become merged into a purposeful and happy team.

As one of the first fruits of the recent Commission of Inquiry into Agricultural Education, the 1947 Summer School was a pronounced success, the outcome of capable leadership and complete organization.

Plate 39.

YOUNG FARMERS IN BRISBANE.—Summer Agricultural School for Primary School pupils, including boys from all parts of the State, on a visit to the Department of Agriculture and Stock.

GENERAL NOTES

Staff Changes and Appointments.

Mr. W. G. Murrell, B.Agr.Sc. (Willoughby, N.S.W.) has been appointed Assistant Bacteriologist in the Division of Animal Industry, Department of Agriculture and Stock.

Egg Board Boundaries.

An Order in Council has been issued under *The Primary Producers' Organisation and Marketing Acts* extending the boundaries of the Queensland Egg Board. In October notice was given of the intention of the Governor in Council to make an Order in Council extending the provisions of the relevant legislation to eggs produced in that portion of Queensland comprised in the shires of Mundubbera, Chinchilla, and Murilla, and in those parts of the shires of Gooburrum, Kolan, Perry, Biggenden, Gayndah, Wondai, Kingaroy, Wambo, Tara, and Waggamba lying west of a straight line drawn from a point at the mouth of the Kolan River (north of Bundaberg) on the southern bank thereof to Hunter Railway Station (near Goondiwindi) on the South-Western Railway, and thence to the southern boundary of the State, and placing eggs produced by growers in such portion of Queensland under the control of the Queensland Egg Board. A petition was invited from growers as to whether or not such Order in Council should be made. Such petition had not been received at the expiration of the prescribed period on 18th November.

Central Queensland Egg Marketing Board.

An order in Council has been issued under the *Primary Producers' Organisation and Marketing Acts* declaring eggs produced by growers in Central Queensland to be a commodity under the abovementioned Acts and constitutes a board, to be known as The Central Queensland Egg Marketing Board, for the period from 9th January, 1947, to 8th January, 1950. The members of the first board appointed for a three years term from the 9th January are:—Messrs. R. H. Webb (Mount Larcom), A. Wynd (Wowan), H. Jones (Ridgelands), H. J. W. Willis (Cremorne, North Mackay), and the Director of Marketing (Mr. H. S. Hunter).

Milk and Cream Pasteurization Plant at Townsville.

An Order in Council has been issued under *The Milk Supply Act* authorising The Atherton Tableland Co-operative Dairy Association Ltd., of Malanda, to establish and carry on a pasteurization plant at Townsville and to supply pasteurized milk and cream within the area of the City of Townsville.

Copper in Proprietary Licks.

An amendment of regulations under *The Stock Foods Acts*, 1919 *to* 1935, provides that the amount of copper which may be present in any stock food shall not be greater than 140 mg. per lb. (approximately ½ oz. per 100 lb.). The amendment will provide for control of the amount of copper which may be included in proprietary licks for use in overcoming a nutritional deficiency in sheep resulting in "steely" wool. It will afford a guide to manufacturers of this class of lick and protection to the users, and thereby reduce the possibility of fatalities from copper poisoning.

Northern Pig Marketing Board.

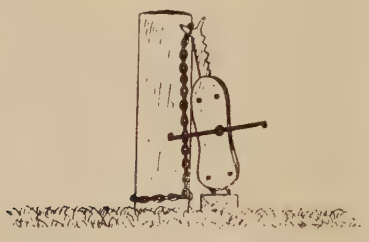
An Order in Council has been issued under the *Primary Producers' Organisation and Marketing Acts* extending the operations of the Northern Pig Marketing Board for the period from 1st January, 1947, to 31st December, 1949. The following have been appointed members of the Board until 31st December, 1949:—Messrs. R. A. Johnston (Hillcrest, Malanda), C. W. Roseblade (Yungaburra), G. R. Barnard (Upper Barron), J. E. Foxwell (Kureen, Malanda), G. H. Henning (Kairi), and H. S. Hunter (Director of Marketing).

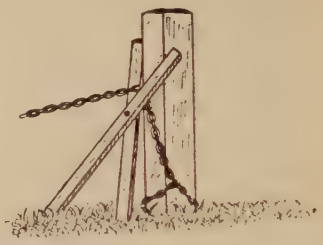
GADGETS AND WRINKLES

HOW TO PULL UP A FENCE POST.

These simple methods of pulling out fence posts cheaply and quickly are particularly useful if a line of posts has to be pulled out.

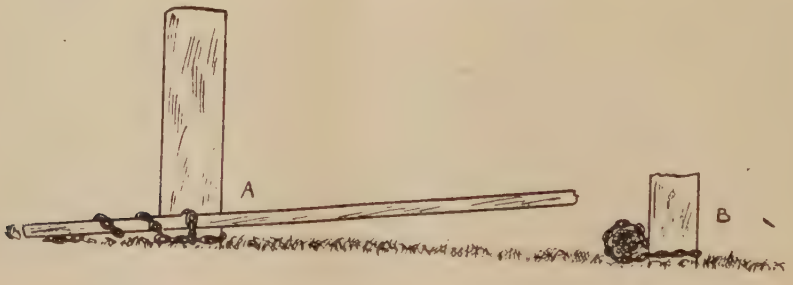
The main essentials are a timber jack and a stout chain, with a strong hook at one end.





The chain is looped round the foot of the post, and the loop is closed with the hook. The remainder of the chain is then lifted and, when taut, one of the links is laid in the lug of the jack, which is held erect and as close to the post as possible. The jack, which must touch the post where the chain engages it, is then wound up and the post comes up with the chain. It is important that the chain be kept taut and that the jack be as near upright as possible. When the ground is wet and sticky the foot of the jack is inclined to sink in as the jack is wound up. This sinking can be avoided by resting the butt of the jack on another post or on a length of 4 in. by 3 in. timber.

On all but the stickiest and tightest country the following method of pulling a post will usually prove successful. Take a strong pole about 12-14 ft. long (white manuka is suitable) and fasten a chain round the foot of the fence post and then to the pole about 2 feet from one end, leaving no slack chain between the pole and the post. By pulling up the far end of the pole the post may be lifted, although it usually pays to loosen the soil around the post before attempting to draw it. The chain must be taken round the lever from the outside so that the first loop can be gripped between the lever and the post. If the process is reversed the lever will simply turn in the operator's hands and will not exert any lift at all. Example "B" explains.



A third simple method useful on light country is to make a V of two pieces of 4 in. by 3 in. timber about 3 ft. long, which are bolted together. The crossed timber should reach between second and third wires from the top of post on the same place as the stay and should touch the post where the chain passes over it. A chain fastened to the bottom of the post is carried over the top of the V and hitched on to the swingle tree, and the post pulled out by a horse.—A. V. Allo, Instructor in Agriculture, Thames (N.Z.), in the *New Zealand Journal of Agriculture*.

Care of Mother and Child.

Under this heading an article supplied by the Maternal and Child Welfare Service of the Department of Health and Home Affairs, dealing with the welfare and care of mother and child, is published each month.

ILL HEALTH OF EMOTIONAL ORIGIN.

IT has been stated that between one-sixth and one-third of all the ailments the medical practitioner meets in his daily round are psychological in origin. A reliable authority in America has reported that the mentally ill occupy more than half the available hospital beds in that country. It is becoming recognized that the vast proportion of ill-health in any community is not due to physical but to psychological causes related to emotional development during childhood. The question arises as to how this can be influenced.

A mother seeks advice because she is worried about her child who is thin and irritable, and perhaps not interested in his food. She has given him various "tonics" without apparent improvement. On examining the child, no physical cause may be found. It then becomes necessary to explain to the mother that the child has emotional needs which are just as vital to his health as dietetic and other physical needs. His earliest emotional need is for maternal love and protection. He requires to feel that he is wanted, and is secure in his family and other relationships. There requires to be harmony in the home; an absence of fear and anxiety on the part of the parents. The child's instinctive curiosity and his need for self-expression and self-assertion require to be recognized and guided into suitable channels.

The ultimate aim of child guidance and care should be the preservation of his health, not correction of behaviour merely because of its nuisance to the family. A child's restlessness, mischievousness, and destructiveness are but expressions of his development; evidences of an active mind, and in order to find an outlet for this activity, a play area and equipment appropriate to the child's development need to be provided.

Parents require to realize that emotional control and self-discipline can best be developed by example.

The building of the health and character of a little child is a greater, more important, and more lasting work than any other civic duty.

Any further information on this or any other matter concerning maternal and child welfare may be obtained by communicating personally with the *Maternal and Child Welfare Information Bureau, 184 St. Paul's Terrace, Brisbane,* or by addressing letters *"Baby Clinic, Brisbane."* These letters need not be stamped.

IN THE FARM KITCHEN.

A Variety of Dishes.

Mutton Brawn.

Take four shanks of mutton, joint and wash, taking care to remove small pieces of bone. Put in saucepan and bring to boil, skim and let simmer until all the meat leaves the bones. Remove bones and gristle and any fat. Add salt and pepper and a small quantity of gelatine. Return to the fire and boil up for a few minutes, then pour into a damp mould to set.

Crummed Ox-tail.

Cut tail into sections, remove fat from fleshy end and cook in salted water till tender. Drain, dip each piece in beaten egg, roll in bread-crumbs and fry golden brown. Serve with tomato gravy. The stock can be used for making soup.

Mixed Vegetable Salad.

Potatoes cut in slices, French beans, young carrots, turnips, beetroot—all these previously boiled, can be used in a salad. Add one tomato and one apple cut in small pieces. Dress with vinegar, salt and pepper, a little chopped onion and tomato sauce. Season one hour before serving.

A Useful Snack.

Make a stiff paste with ¾ lb. flour, ¼ lb. fat, ½ teaspoon salt, a little warm water. Work well and roll out thinly. Cut into large rounds. On each round place a little force-meat, made with left-over cold meat mixed with a little chopped onion, parsley, and mixed herbs, highly seasoned with salt and pepper, or use cold cooked vegetables, cut into dice, or sausage meat. Fold the paste over this, see that it is well sealed on all sides, damping it slightly if necessary to make it hold together, and bake in a moderate oven.

Green Pea Salad.

Cooked peas, lettuce leaves, salad cream, cucumber and tomatoes. Arrange small lettuce leaves on plate so that the stalks meet in the centre. Mix the peas with some salad cream and pile them up in the centre of the plate. Decorate with a ring of tomato and cucumber slices.

A Good Cheese Souffle.

Quarter pound of butter (melted), 2 oz. flour, ¼ lb. grated cheese, two heaped tablespoonfuls of bread-crumbs, quarter pint milk, three eggs, salt and cayenne pepper. Mix flour, butter, and seasoning. Stir in milk; bring slowly to boil, stirring all the time. Add cheese, bread-crumbs, and beaten egg yolks. When cool fold in stiffly-beaten whites. Pour into well-buttered souffle or pie-dish and bake a delicate brown. Serve immediately.

Fruit Melba.

Prepare 1½ lb. rhubarb, gooseberries or cherries and stew till almost done with 1½ tablespoons sugar and ½ pint water. Be careful to keep the fruit whole; if using rhubarb weigh it after it is sliced. When ready drain off juice, measure it, turn into a saucepan and add a little red jam, allowing 1 tablespoon to ¼ pint of juice. Mix these together, boil a few minutes, and add the fruit. When cold serve with custard.

Ragout of Vegetables.

Two parsnips, carrots, onions, potatoes, some finely-chopped parsley, 2 oz. butter, pint of milk, seasoning, 2 meat cubes, 2 tablespoonfuls dried green peas which have been soaking all night. Prepare and slice vegetables. Melt the butter in a pan, and fry the vegetables, stirring them from time to time, add parsley, and dissolve cubes. Season and simmer in the milk until vegetables are quite hot, adding the boiled peas last. Serve in a hot dish.

QUEENSLAND WEATHER IN JANUARY.

In marked contrast to a poor seasonal rainfall distribution over practically the whole State during January, 1947, the South Coast, Moreton, and East Darling Downs Divisions had district rainfall averages of 66 per cent. and 45 per cent. above normal, respectively. This heavy to flood rain resulted from a cyclone which crossed the Queensland coast approximately 40 miles north of Brisbane and recurved over the south-east corner of the State during the 23rd to 26th, bringing considerable benefit to this important food producing area despite the damage resulting, in parts, from flooding and high winds. For the four days ended 9 a.m. 26th, Springbrook had 5567 points (2780 for 24 hours to 9 a.m. 25th—previous highest 1523, 6 February, 1931), Mount Tamborine 3983, Nerang 2777, and there were many other totals over 10 inches. The eastern Downs had general 3 to 6 inch falls. Port Curtis had 3 inch totals about Bundaberg, but variable registrations elsewhere, and falls on western Downs were light only Flooding was particularly heavy in the Logan and Albert River Basin, the highest since 1887 and 1893. At Slacks Creek, flood waters reached telephone wires; the following peak river heights were reported—Logan River, Dulbolla 45 ft. 9 ins. (25th), Beaudesert 47 ft. 9 ins. (25th). Albert River, Bromfleet 52 ft. 6 ins. (25th), Lumeah 32 ft. (25th). Lower tributaries of the Brisbane River rose as follows—Warrill Creek, Harrisville, 24 ft. 9 ins. (25th), highest since 27 ft. 4 ins., 17 February, 1893, and Bremer River, Ipswich, 46 ft. 6 ins. (26th), highest since 47 ft. 5 ins., 7 February, 1931. There were moderate rises also in the Condamine and MacIntyre Rivers. Rail, road, air and shipping traffic was disrupted by the cyclone. Two lives were lost in the floods. Serious soil erosion occurred and flood damage to roads, bridges, farm property, fencing etc., and crops was estimated at over £500,000.

Apart from the Moreton and East Downs Divisions, district average totals were well below normal, especially in the South-West, Central-West and Tropical Coast Divisions where deficiencies ranged above 80 per cent. Rainfall inland was of the patchy thunderstorm type, the Maranoa (47 per cent. below normal) and Central Lowlands (51 per cent. below) faring better than other Divisions compared to averages. A district average of 156 points for the Central Lowlands was the best there since January last year. Excluding the south-east corner of the State, only six stations of the telegraphic network had monthly totals above normal.

Pressure.—Moderate to rough seas developed along the whole coastline on 20th, substantiating suspicions of a deepening depression over the Coral Sea which was located as an intense cyclonic centre approximately 450 miles E.S.E. of Willis Island at 9 a.m. on the 21st moving southerly to south-west. The cyclone continued this movement on 22nd developing very rough seas and gale south-east winds south from Rockhampton, increasing to high seas and heavy gale south-easterlies by 23rd when the cyclone (below 29.3 inches) crossed the coast in the vicinity of Caloundra approximately 40 miles north of Brisbane.

Temperatures.—Average maximum temperatures reached record or near record figures in many inland centres, being generally above normal by as much as 4 to 7 degrees; average minimum temperatures ranged up to 5 degrees above normal. In Western and Central Divisions, stations reported temperatures of 100 degrees or over for 25 to 30 days of the month. Urandangie had 11 consecutive days of 110 degrees or over (19th to 29th) and Boulia 9. Maximum temperatures of 118.3 degrees Longreach (26th), 118 degrees Boulia (28th), 114.4 degrees Barcaldine (26th), established new records for those towns, while Windorah 116 degrees (27th), Urandangie 115 degrees (25th and 28th), and Adavale 115 degrees (26th), equalled the previous highest for January.

Brisbane.—Mean pressure 9+3 29.870 inches (normal 29.869). *Temperatures.*—Mean maximum 84.8 degrees (normal 85.4 degrees), mean minimum 70.9 degrees (normal 69.1 degrees), mean temperature 77.9 degrees (normal 77.3 degrees); highest daily 91.6 degrees (27th, lowest daily 65.9 degrees (6th). *Rainfall.*—1191 points on 14 days (average 628 on 13 days). (Up to January 22nd the Bureau had only recorded 23 points, which was the lowest on record for 1st/21st January in any year). *Sunshine.*—Mean daily 7.7 hours (normal 7.4). *Maximum wind gust.*—South 50 miles per hour (23rd).

The rainfall position summarised—

Division.	Normal Mean.	Mean Jan., 1947.	Departure from Normal.	Progressive Totals, May to end of January.	
				Normal.	1947.
	Points.	Points.	Per cent.	Points.	Points.
Peninsula North	1389	557	60 below	2605	1481
Peninsula South	935	555	41 „	1980	1314
Lower Carpentaria	725	239	67 „	1453	576
Upper Carpentaria	628	230	63 „	1478	695
North Coast Barron	1328	238	82 „	3274	1033
North Coast Herbert	1411	65	95 „	3852	744
Central Coast East	893	122	86 „	2340	565
Central Coast West	537	79	85 „	1504	438
Central Highlands	400	165	59 „	1670	721
Central Lowlands	321	156	51 „	1187	372
Upper Western	316	73	77 „	869	352
Lower Western	170	26	85 „	736	113
South Coast Port Curtis	658	232	65 „	2484	1230
South Coast Moreton	671	1112	66 above	3059	2241
Darling Downs East	375	543	45 „	2044	1690
Darling Downs West	298	111	63 below	1607	827
Maranoa	302	159	47 „	1583	707
Warrego	214	19	91 „	1202	307
Far South-west	191	29	85 „	913	144

Commonwealth of Australia, Meteorological Bureau, Brisbane.

ASTRONOMICAL DATA FOR QUEENSLAND.

MARCH.

Supplied by the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Date.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	5.41	6.20	Cairns	32	26	Longreach	36	34
6	5.44	6.15	Charleville	27	27	Quilpie	35	35
11	5.46	6.10	Cloncurry	52	47	Rockhampton ..	11	9
16	5.49	6.04	Cunnamulla ..	29	29	Roma	17	17
21	5.52	5.59	Dirranbandi ..	19	19	Townsville	26	22
26	5.54	5.53	Emerald	20	18	Winton	42	38
31	5.57	5.48	Hughenden ..	36	33	Warwick	4	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Date.	Rise.	Set.
	p.m.	p.m.
1	1.25	11.59
2	2.30	a.m.
3	3.32	12.59
4	4.27	2.03
5	5.16	3.11
6	5.59	4.19
7	6.37	5.25
8	7.12	6.27
9	7.45	7.28
10	8.18	8.26
11	8.51	9.24
12	9.26	10.20
13	10.04	11.17
		p.m.
14	10.47	12.12
15	11.33	1.07
	a.m.	
16	..	1.58
17	12.23	2.47
18	1.16	3.31
19	2.12	4.12
20	3.10	4.49
21	4.07	5.24
22	5.05	5.58
23	6.03	6.31
24	7.03	7.04
25	8.04	7.40
26	9.07	8.19
27	10.12	9.03
28	11.19	9.54
	p.m.	
29	12.24	10.52
30	1.26	11.54
31	2.22	..

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Date.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	11	29	26	44	0	20	28	52
6	14	26	29	42	4	17	33	49
11	24	14	41	30	16	5	47	34
16	30	10	45	24	20	0	53	27
21	24	15	41	30	16	6	47	35
26	14	25	29	41	4	17	33	49
31	11	28	26	43	0	19	28	51

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Date.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	7	52	36	65	20	50	7	44
3	6	53	35	66	20	51	6	44
5	11	49	38	63	23	49	10	41
7	21	39	44	57	29	42	18	34
9	32	29	52	50	36	35	26	25
11	42	18	58	43	43	27	35	17
13	50	10	64	37	48	23	41	10
15	52	7	66	35	50	21	43	8
17	54	5	67	34	51	20	44	6
19	50	10	64	37	48	23	41	10
21	42	19	58	43	43	28	35	17
23	32	29	52	50	36	35	26	25
25	21	39	44	57	29	42	18	34
27	11	49	38	63	23	49	10	41
29	5	53	35	66	19	51	5	44
31	7	49	36	63	20	49	7	41

Phases of the Moon.—Full Moon, March 7th, 1.15 p.m.; Last Quarter, March 15th, 4.28 a.m.; New Moon, March 23rd, 2.34 a.m.; First Quarter, March 30th, 2.15 a.m.

Equinox.—On March 21st at 9 p.m. Eastern Australian Standard Time the Sun will cross the equator and will then rise at true east and set at true west. After this date the Sun will appear to move northward until June 22nd when it will reach its maximum declination north.

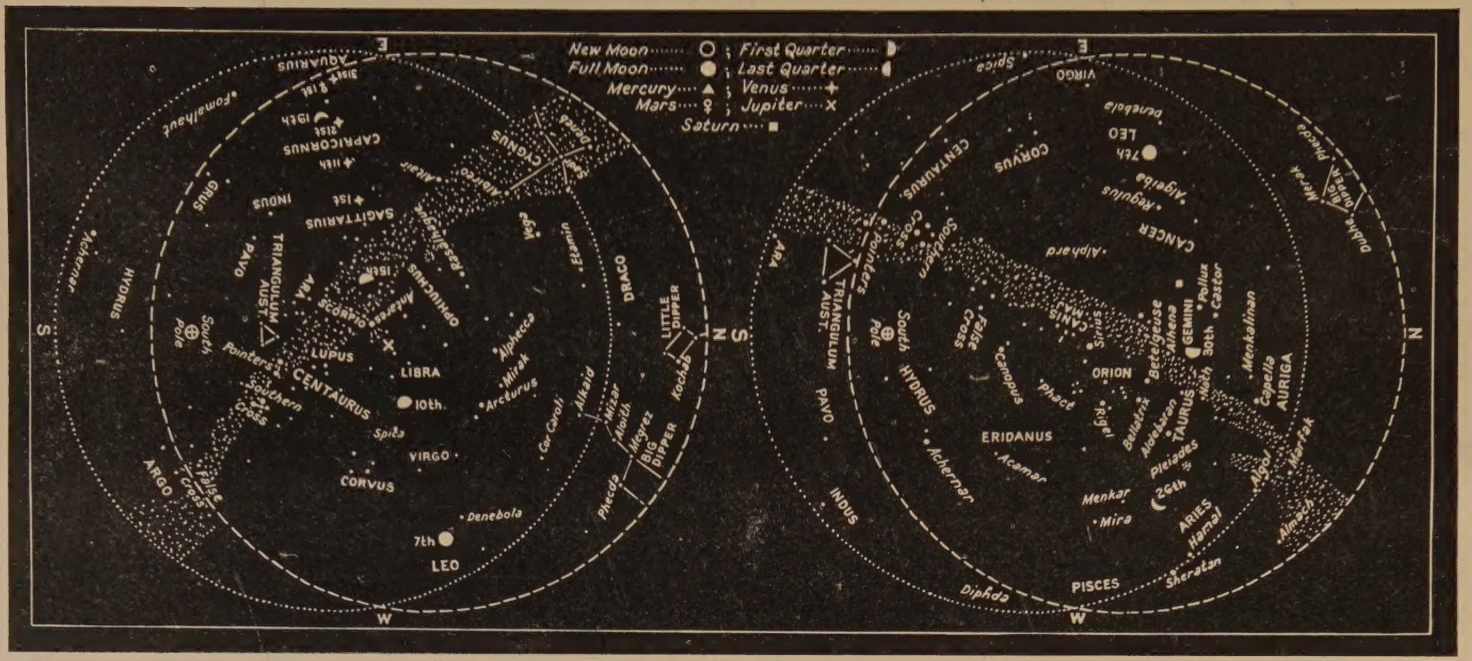
On March 9th and 23rd the moon will set at true west.

Mercury.—At the beginning of the month, in the constellation of Pisces, will set about 30 minutes after the Sun and on the 8th will be in line with the Sun, after which it will become a morning object. On the morning of the 17th it will pass about 4 degrees north of Mars, and at the end of the month, in the constellation of Aquarius will rise about 2 hours before the Sun and will be positioned between Venus and Mars.

Venus.—In the constellation of Sagittarius, at the beginning of March, will rise between 2.15 a.m. and 3.15 a.m. By the end of the month it will reach the constellation of Aquarius and will rise between 3 a.m. and 4 a.m.

Mars.—Still rather too close in line with the Sun for observation, rising about 1 hour Sunrise at the beginning of the month and about 1½ hours before the Sun at the end of the month.

Jupiter.—At the beginning of March, in the constellation of Libra, will rise between 10.15 p.m. and 11.15 p.m. On the 12th the moon will pass in front of this planet, obscuring it from view. From Queensland generally the planet will pass from view at the bottom right-hand side of the moon and will be seen again, about 1 hour later, at the top left-hand side of the moon. The calculated time of disappearance at Brisbane is 10.59 p.m.,



at Rockhampton 10.52 p.m. and at Cairns 10.42 p.m., but the moon then will not be far above the eastern horizon. The times of reappearance at these places are 11.56 p.m., 11.50 p.m., and 11.41 p.m. respectively; the moon then being more favourably placed for observation. That portion of the moon at which the planet disappears will be illuminated, but the spot at which it reappears will be dark.

Saturn.—In the constellation of Cancer will rise before sunset and at the beginning of the month will set between 2.50 a.m. and 4 a.m., and at the end of the month about 1 hour after midnight.

Star Charts.—The chart on the right is for 7.15 p.m in the south-east corner of Queensland to 8.15 p.m. along the Northern Territory border on the 15th March. (For every degree of longitude we go west, time increases 4 minutes.) The chart on the left is for 9 hours later. On each chart the dashed circle is the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. When facing north hold "N" at the bottom; when facing south hold "S" at the bottom and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour enrlier than that time. The positions of the moon and planets, which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

JANUARY RAINFALL.

(Compiled from Telegraphic Reports).

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Jan.,	No. of years' records.	Jan., 1946.	Jan., 1947.		Jan.,	No. of years' records.	Jan., 1947,	Jan., 1947.
North Coast.	In.		In.	In.	*South Coast—contd.*	In.		In.	In.
Atherton	11·52	42	19·41	4·42	Gatton College ..	4·32	44	9·27	Nil
Cairns	16·43	61	12·81	3·63	Gayndah	4·70	72	7·10	1·64
Cardwell	16·99	71	25·54	0·22	Gympie	6·57	73	5·08	3·71
Cooktown	14·10	67	9·86	1·31	Kilkivan	5·63	62	9·28	1·63
Herberton	9·31	57	13·93	2·20	Maryborough ..	6·97	72	5·70	6·23
Ingham	15·96	51	26·59	1·42	Nambour	9·37	47	9·30	7·25
Innisfail	20·24	62	30·22	0·81	Nanango	4·65	61	5·19	2·00
Mossman	18·87	19	19·40	5·32	Rockhampton ..	7·39	72	9·71	0·42
Townsville	11·05	72	15·68	0·35	Woodford	7·72	55	6·58	6·03
Central Coast.					*Darling Downs.*				
Ayr	10·95	56	14·09	0·51	Dalby	3·44	73	5·24	4·61
Bowen	9·65	72	18·57	0·19	Emu Vale	3·22	47	7·35	8·84
Charters Towers ..	5·35	61	10·10	0·48	Jimbour	3·51	64	6·91	3·12
Mackay	13·50	72	15·60	1·66	Miles	3·83	58	8·44	2·23
Proserpine	14·95	40	29·12	2·02	Stanthorpe	3·68	70	6·93	6·61
St. Lawrence ..	8·93	72	13·13	0·82	Toowoomba	5·16	71	10·95	4·79
					Warwick	3·58	78	8·07	5·55
South Coast.					*Maranoa.*				
Biggenden	5·25	44	7·69	1·97	Roma	3·20	69	2·21	2·18
Bundaberg	8·52	60	4·91	3·47	St. George	2·64	62	4·62	0·24
Brisbane Bureau ..	6·28	95	4·68	11·91					
Caboolture	7·96	67	5·72	9·92					
Childers	7·23	48	8·43	3·46	*Central Highlands.*				
Crohamhurst	11·78	50	7·21	7·87	Clermont	5·02	72	4·32	1·98
Esk	5·64	56	3·45	6·92	Springsure	4·21	74	6·33	1·61

CLIMATOLOGICAL TABLE FOR JANUARY, 1947.

(Compiled from Telegraphic Reports.)

Divisions and Stations.	Atmospheric Pressure Mean at 9 a.m.	Shade Temperature.		Extremes of Shade Temperature.				Rainfall.	
		Mean Max.	Mean Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Pts.	
Cairns	..	90	76	97	24	71	30	363	10
Herberton	..	87	64	95	27	61	23, 26	220	6
Townsville	..	91	78	96	24	70	18	35	3
Rockhampton	29·85	94	74	103	24, 25, 26	69	17, 18	42	3
Brisbane	29·90	85	71	92	27	66	6	1191	14
Darling Downs.									
Dalby	..	92	77	99	9, 12,	58	9	461	10
Stanthorpe	..	84	61	93	12, 16, 17	51	8	661	10
Toowoomba	..	85	64	94	10. 12	58	8	479	9
Mid-Interior.									
Georgetown	29·82	97	74	101	24	69	17	456	10
Longreach	29·80	103	77	118	26	68	12	139	6
Mitchell	29·84	99	71	109	27	60	6	145	5
Western.									
Burketown	..	98	77	105	1	69	23	333	6
Boulia	29·74	108	80	118	28	66	8, 9	10	2
Thargomindah	29·80	103	77	111	26. 28	70	5	2	1

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